

Grade 8

Mathematics

Teacher's Instructional Manual

**Department of Mathematics
Faculty of Science and Technology
National Institute of Education
Maharagama
2009**

Mathematics

Grade 8 – Teacher’s Instructional Manual

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**Department of Mathematics
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Message of the Director General

The first curriculum revision for the new millennium aims to eliminate several problems that exist in the present education system. Having identified the problems that youth face due to the weakening of thinking, social and personal skills, and investigating step by step the factors that have resulted in this situation, this curriculum reform has been planned in order to create the environment that is necessary to overcome this.

Our country took the lead in education in the Asian region in the past. However many other countries in this region have now advanced ahead of us. Some of the factors that have caused this decline are the actions that have been taken continuously by the educational institutions over a period of time, to retain what is known, to learn the pre-determined and construct what is in the same manner as before.

By taking all these factors into consideration, the officers of the National Institute of Education have endeavored to compile the new curriculum with a clearer vision. The primary objective of this curriculum is to produce a generation of students who will display their readiness for a successful future, by changing what is known, exploring what is new and building up what is required for the future. It is unnecessary to reiterate that to fulfill this goal, there should be a distinct change in the teacher's role. Instead of the transmission and transactional teacher role that has been prominent in our classrooms to date, teachers in the Sri Lankan schools will have to understand and familiarize themselves with a student centered, competency based and activity focused transformational role under this new curriculum.

It is our firm belief that this Teacher's Instructional Manual will aid you to adapt yourself to the new situation and to become an effective teacher in the new millennium. By following these instructions you will be helped in your daily teaching and evaluation duties. There is no doubt that the instructions for student exploration and other quality inputs will also facilitate the teacher's task. This Teacher's Instructional Manual also provides valuable information to school principals regarding the preparation of timetables, sharing of limited resources and internal supervision.

My sincere thanks go to Dr. Mrs. I. L. Ginige, Assistant Director General (Curriculum Development), Faculty of Science & Technology of the National Institute of Education for her direct involvement in the preparation of this Teacher's Instructional Manual. My thanks are also due to the other officers and all other personnel who aided in the preparation of this manual that will serve not only the above mentioned persons involved at the school level but also the teacher educationists involved in beginning or in continuous teacher education duties, in-service advisors as well as officers at various levels who are involved in external supervision and monitoring programmes.

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Preface

Two years have passed since the implementation of the first curriculum reforms of the new millennium. The curriculum material prepared for grades 6 and 7 of the junior secondary level and grades 10 and 11 of the senior secondary level now belong to the system. At this point when exactly half of the programme of introducing the curriculum reforms to the schools has been completed, by reflecting on the experience gained so far and learning from it, we need to make an effort to contribute new thinking towards the positive development of the country.

This curriculum reform has provided us with the opportunity to break away from the familiar reactive approach and turn towards a proactive approach. Therefore, let us revise what is known instead of retaining the known, explore what is unknown instead of learning the pre-determined and develop what the future requires instead of reconstructing what is available at present. Let us use a new approach that is competency-based, student-centred and activity-oriented under a new teaching role, to actualize this vision.

A teacher who guides students to search for knowledge and meaning in the learning-teaching process should be well prepared to transform the students into citizens who are integrated personalities. The teacher should take complete responsibility to develop the thinking ability and social and personal skills of each and every student in the classroom. The teacher should aid in creating a new society that can make right decisions, solve problems and resolve conflict by providing students with the opportunity to think in new ways, to develop a maturity through daily experiences, to display the ability to analyze and to argue in inductive and deductive ways.

There are many opportunities to aid students to develop social skills under the new teaching role. The opportunities for students to be considerate and attentive towards others and to share with others are many, during the time that they engage in activities in groups. By sharing the discoveries made in small groups with everyone else in the classroom, the students are provided the opportunity to prepare to face future challenges and overcome them. The future will not allow us to depend on teachers to gain new knowledge. The reason for this is that the rate at which knowledge is expanding increases from day to day. We need to learn to consider our peers as learning resources from a young age due to this reason. By different small groups exploring different aspects of the same problem and sharing their findings and experiences with all students, even complex problems can be solved easily and quickly. Students also get used to searching for new knowledge by reading, discussing, observing, engaging directly in a task and reflecting, instead of asking everything from the teacher. The teacher who forms small groups and assigns the tasks avoids appointing a leader. The groups become active only in such situations. Also, students with hidden abilities for certain tasks become active as a group to actualize a common goal only in such situations. Students, who engage in contributing towards others knowledge from what they know, and gaining knowledge from others in this manner, by being provided with the valuable opportunity of listening, speaking, reading and writing, practice their communication skills unconsciously.

It is the responsibility of the teacher to ensure the active participation of all the students in the group in the proposed exploration. For this, the teacher uses her own skills to form mixed groups. The teacher works towards getting the students who have already gained the

required base knowledge to help other students. She/he guides the small groups to share responsibilities equally, and to present the findings as a group. She/he discourages the students from reading a previously prepared solution in the class, but instead guides them to make a creative presentation. The teacher encourages students to complete the tasks during the allocated time. After displaying all the student work in front of the classroom the teacher ensures that the attention of all the students is focused on the presentations that are made. Also, at the end of each presentation, the teacher obtains the ideas of the group who presented their findings as well as the other groups who were listening to the presentation, and provides students with the opportunity to clear up any doubts, correct any errors and cover all the factual shortcomings. All this give a hand to the school to awaken student skills that were previously suppressed and to create a generation that is not isolated in society.

The new science of methodologies that has emerged in the new millennium has been invaluable in aiding those who learn to develop their skills and self. Students who work in groups learn to be patient with others. They also get out of the habit of losing their temper over unimportant issues and learn tolerance toward other's opinions. Here, prioritization which is fundamental in managing stressful conditions, doing quality work, avoiding chats which result in wastage of time and instead using this time to develop one's self, and developing virtues such as planning which enhances productivity in work take precedence. Students, who get into the habit of initiating new things and supporting effective changes introduced by others, display self-understanding, take appropriate risks and develops entrepreneur skills. Under the science of new methodologies, the opportunities for students to take responsibility and be responsible are many. The teacher who guides the learning-teaching process so that all these instances are made possible, aids in creating a new generation that is committed towards national service and are independent in thought, and enhances his/her own professional satisfaction.

In the new millennium, assessment and evaluation are given a special position in the activities that a Sri Lankan teacher should carry out. The task that the teacher should be engaged in throughout the period that the students are involved in exploration is assessment. The three main tasks under assessment are to observe the students closely, determine their levels and act to bring them to the position they ought to be at. The teacher should provide leadership to bring all students from the darkness to light by providing feedback to the weaker students and feed-forward to the capable students. There is no necessity to emphasize that the evaluations done under sufficient assessment will bring about successful results. The teacher, who assesses the students in the exploration process, evaluates them when they are engaged in explanations and elaborations. The teacher should not forget to inform the students about the proficiency level the groups have approached and to provide encouragement.

Apart from the assessment and evaluation carried out during each activity, the evaluation and assessment carried out through a group of activities is extremely important. The special feature of this evaluation which is considered as the second instant of school based evaluation is that the teacher has the opportunity to take teaching and student learning out of the time-table. The teacher has the freedom to carry out this assessment and evaluation by using the enlightening learning-teaching-evaluation instruments which are described in the third part of the teacher's instructional manual, and by following the 5 steps of the 5E model. Every teacher should make an effort to get the maximum out of this learning-

teaching-evaluation process by providing the small groups with the opportunity to meet the teacher at least once a week, by examining the learning outcomes that the students have acquired and by aiding them in solving problems.

Steps have been taken to reduce the number of evaluations per term so that it is not a burden to the teacher. Accordingly, for any subject, if the number of periods per week is more than three, there are 4 instances of evaluation, if the number of periods per week is three, there are 3 instances of evaluation, and if the number of periods per week is less than three, there are 2 instances of evaluation. The final instance of evaluation is the term test. This is the only instance when the students are required to face a written test. The teachers are required to complete the first few evaluations by using the enlightening evaluation instruments that have been presented by the National Institute of Education curriculum developers under the third section of this manual. It is appropriate to prepare compulsory questions for the term tests and the G.C.E. O'level examination to test the students on the experience they gained through these instruments. All these provide students with the space to engage in meaningful independent or group study outside the time table.

It is certain that the organization and inclusion of, the activity continuum necessary for the success of the learning teaching process and the learning-teaching-evaluation instruments which are required for the school based evaluations to be meaningful, in the second and third sections of this teacher's instructional manual will facilitate the teacher's task. But the teacher should also remember that she has the freedom to alter the material based on the size of the class and its nature or to use her own creations in a manner such that the expected goals are realized.

The support provided by the national examinations towards the realization of any developmental changes that are proposed in the learning-teaching process is great. Understanding this situation, the Department of Examination is prepared to make a noticeable difference in the examination papers. It has been decided to introduce an authentic evaluation scheme for the term tests and the G.C.E. O'level which is based on real life situations, stepping away from the usual questions under the themes of what? why? when? where? who? and how? that can be guessed beforehand. We believed that this programme which has been initiated by the National Institute of Education to create a student who will gain experience for life, instead of someone who just fills his head with knowledge and faces the examination successfully but forgets everything in a few days, will catch the attention and acceptance of and form a base for the active involvement of all those who are committed to the development of the country.

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Contents

| Chapter | Page |
|--|-------------|
| 01. Descriptive Syllabus | 1 |
| • Introduction | 2 |
| • Aims of learning mathematics | 4 |
| • Competencies, competency levels and subject content | 6 |
| • Relationship between subject themes and content | 17 |
| • Sequence of lessons | 25 |
| • School policies and programmes | 26 |
| 02. Learning - Teaching Methodology | 28 |
| • Introduction | 29 |
| • Activity continuum | 32 |
| 03. Assessment and Evaluation | 182 |
| • Introduction | 183 |
| • Instruments for the extension of the learning-teaching process | 185 |

Descriptive Syllabus

Introduction

The grade 8 Mathematics syllabus has been prepared based on the competencies that students who learn Mathematics from grade 6 to grade 11 should actualize. To guide the students towards actualizing these competencies by grade 11, the competency levels that students should actualize in each grade have been identified and organized. Accordingly, the competency levels that grade 8 students should approach, and the special learning outcomes required to achieve this are included in this syllabus. The subject content, teaching sequence and the time periods required to implement the learning, teaching, assessment and evaluation process which is based on the subject content and which will aid the students to realize these special learning outcomes are also included here.

The competency based syllabi prepared for the subject Mathematics, were implemented in grade 6 and grade 10 in 2007 and is presently operational. A policy decision has been made to operate it in grade 8 from 2009.

The subject content of this syllabus has been organized so that the following aims of learning mathematics are achieved.

- Calculations related to Knowledge and Skills
- Communication
- Identifying Relationships
- Reasoning
- Problem Solving

It is expected that through this syllabus, mathematics will not just be limited to knowledge but that the skills required in practical life as well as virtues and life habits based on social experiences will be developed. In implementing this learning, teaching, assessment and evaluation process,

- by providing opportunities for meaningful discovery, learning can be made more student centered
- guidance is provided for grade 8 students to achieve the various competencies appropriate for their mental level and to develop these throughout their lives.
- the aims of learning, teaching, assessment and evaluation become clearer.
- since it is possible to identify how far each student has progressed towards achieving each competency level, it is easy for the teacher to provide the required feedback and feed-forward.
- the opportunity is given for students to develop the necessary mathematical concepts as well as the principles related to them.
- the teacher is able to step away from traditional teaching methods and enter into a transformation role.

When operating this mathematics syllabus in the classroom, new teaching strategies should be developed by associating the various phenomena that appear under each topic with the needs of the region.

In the learning, teaching, assessment and evaluation process, since the opportunity to develop activities for each competency level is provided, assessment of the competency level that the student is approaching is facilitated.

In addition, the following aspects

- the aims of learning mathematics
- proposed teaching sequence and number of periods
- the teaching strategies
- the school policies and programmes
- assessment and evaluation

that aid in carrying out the various duties related to teaching mathematics in schools are also presented in this syllabus..

Aims of learning mathematics

The following objectives should be aimed at and achieved to further develop the mathematical concepts, creativity and sense of appreciation in students entering the junior secondary stage, so that their mathematical thinking, understanding and abilities are enhanced.

- (1) The development of computational skills through the provision of mathematical concepts and principles as well as the knowledge of mathematical operations, and the development of the basic skills of solving mathematical problems with better understanding.
- (2) The development of correct communication skills by enhancing the competencies of the proper use of oral, written, pictorial, graphical, concrete and algebraic methods.
- (3) The development of relationships between important mathematical ideas and concepts, and the use of these in the study and improvement of other subjects. The use of mathematics as a discipline that is relevant to lead an uncomplicated and satisfying life.
- (4) The enhancement of the skills of inductive and deductive reasoning to develop and evaluate mathematical conjectures and arguments.
- (5) The development of the ability to use mathematical knowledge and techniques to formulate and solve problems both familiar and unfamiliar that arise in day to day life.

1. Knowledge and Skills

It is expected that students will acquire basic skills and gain understanding of concepts, principles and methods by learning mathematics. These can be used as tools to apply mathematical thinking in other fields, and also as a base for further mathematical activities. It is necessary to keep in mind the recent developments in technology when deciding on the skills and knowledge that the students should gain by memorizing or learning, as scientific calculators and symbolic processes which are affordable, more powerful and mechanical have an influence on senior secondary schools.

2. Communication

Due to the fact that mathematics has the power to communicate and represent ideas concisely and with clarity, the use of it in other disciplines has increased tremendously. Guaranteeing that students come to a common agreement regarding concepts and definitions should be an important component of the school curriculum.

This can be accomplished by providing students with the latitude to explain their ideas both orally and in writing, to think intuitively, and to defend their ideas. Through such

activities, the skills of exchanging knowledge and working with amity in co-operation with others are guaranteed. These are considered as higher skills in the modern world of work.

3. Relationships

Students are often inclined to think of mathematics as a series of isolated and unrelated truths and processes. It is therefore important to educate them about the many relationships that exist even in the learning of mathematics through graphical, numerical, physical and algebraic representations or models. Students should recognize that mathematical thinking and modeling are used to solve problems in other fields such as the Biological, Physical and Social Sciences, Arts, Music and Commerce, as well as in day to day life. They should also understand the manner in which mathematics has been related to our culture both local and foreign, in the past as well as in the present.

4. Reasoning

The argument that has existed for years to pay greater attention to mathematics in the school curriculum is due to the belief that by learning mathematics, students will be able to develop clear and logical thought.

Although the principles of logic form the base for deductive reasoning in mathematics, there are many developments in mathematics based on induction, i.e., on conjectures that are proved by deductive reasoning, by first identifying patterns. The development of mathematics has occurred through the interactions that take place between various observations, identification of patterns, making assumptions and proving theorems. Students should be educated regarding these various aspects of mathematical thought and should also develop the skills related to each of them.

5. Problem Solving

For a student to become a productive citizen it is essential that he/she develops problem solving skills. Problem solving is a common investigative path through which students develop an awareness of the usefulness and power of mathematics. Students will face various issues when they attempt to use logical and creative thought to analyze a mathematical method by which a wrong conclusion has been arrived at. But in every situation, the students have the ability to solve problems that are within the scope of the knowledge they have gained. Suitable methods should be developed to evaluate and appreciate the success of these efforts by students and these evaluation methods should be incorporated into the regular evaluation scheme.

3 Syllabus

Grade 8 – Mathematics

| Competencies, Competency Levels | Subject Content | Periods |
|---|--|---------|
| <p>Competency – 1 Manipulates the mathematical operations in the set of real numbers to fulfill the needs of day to day life.</p> <p>1.1 Inquires into the relationships between whole numbers.</p> <p>1.2 Manipulates directed numbers under the basic mathematical operations.</p> | <ul style="list-style-type: none"> • Square (1 – 20) • Square Root (1 – 1000) <ul style="list-style-type: none"> • By Observation • Using Prime Factors • Integers <ul style="list-style-type: none"> • Subtraction • Multiplication • Division • Directed Numbers <ul style="list-style-type: none"> • Subtraction • Multiplication • Division | 10 |
| <p>Competency – 2 Makes decisions for future requirements by investigating the various relationships in number patterns.</p> <p>2.1 Builds relationships between the terms of number patterns by investigating various properties.</p> | <ul style="list-style-type: none"> • Common Term of Number Patterns <ul style="list-style-type: none"> • Square Numbers • Triangular Numbers • Odd Numbers • Even Numbers • Multiples of Numbers | 05 |
| <p>Competency – 3 Manipulates units and parts of units under the mathematical operations to easily fulfill the requirements of day to day life.</p> | | 18 |

| Competencies, Competency Levels | Subject Content | Periods |
|--|---|---------|
| <p>3.1 Manipulates units and parts of units under multiplication.</p> <p>3.2 Manipulates units and parts of units under division.</p> <p>3.3 Manipulates decimal numbers under the mathematical operations of multiplication and division.</p> | <ul style="list-style-type: none"> • Multiplication <ul style="list-style-type: none"> • Whole Number by a Fraction • Fraction by a Fraction • Fraction by a Mixed Number • Mixed Number by a Mixed Number • Reciprocal <ul style="list-style-type: none"> • Of a Whole Number • Of a Fraction • Division <ul style="list-style-type: none"> • Whole Number by a Fraction • Fraction by a Fraction • Fraction by a Mixed Number • Mixed Number by a Mixed Number • Multiplication and Division <ul style="list-style-type: none"> • Whole Number by a Decimal Number • Decimal Number by a Decimal Number | |
| <p>Competency - 4 Uses ratios to facilitate day to day activities.</p> <p>4.1 Uses ratios in day to day activities.</p> <p>4.2 Solves problems constructing relationships between two ratios.</p> | <ul style="list-style-type: none"> • Dividing into a Ratio <ul style="list-style-type: none"> • With respect to Money and Time • The Total Amount when a Ratio is given • Compound Ratios (Using equivalent ratios) | 05 |

| Competencies, Competency Levels | Subject Content | Periods |
|---|--|---------|
| <p>Competency - 5 Makes successful transactions in the modern world by using percentages.</p> <p>5.1 Develops the relationship between fractions, ratios and percentages.</p> <p>5.2 Solves problems related to percentages.</p> | <ul style="list-style-type: none"> • Fractions \leftrightarrow Percentages • Ratios \leftrightarrow Percentages • Solving Problems <ul style="list-style-type: none"> • Percentage of a Quantity • Quantity when a Percentage is given | 06 |
| <p>Competency – 6 Easily solves mathematical problems in day to day life by using logarithms and calculators.</p> <p>6.1 Simplifies powers of a product using expansion.</p> <p>6.2 Expands a power of a negative integer and finds the value.</p> | <ul style="list-style-type: none"> • Expansion of a Power of a Product $(ab)^n \leftrightarrow a^n b^n$ ($n \leq 3$) • Power of a Negative Integer (Index 1 - 4) | 05 |
| <p>Competency – 7 Carries out daily tasks effectively by investigating the various methods of finding the perimeter.</p> <p>7.1 Satisfies various requirements by investigating the perimeter of rectilinear plane figures</p> | <ul style="list-style-type: none"> • Perimeter <ul style="list-style-type: none"> • Compound Plane Figures (Consisting of two figures from Equilateral Triangles, Isosceles Triangles, Squares, Rectangles) | 05 |

| Competencies, Competency Levels | Subject Content | Periods |
|---|---|-----------|
| <p>Competency – 8 Makes use of a limited space in an optimal manner by investigating the area.</p> <p>8.1 Finds the area of compound plane figures in the environment and has an awareness of the space allocated for them.</p> <p>8.2 Fulfills daily needs by investigating the surface area of various solids.</p> | <ul style="list-style-type: none"> • Area <ul style="list-style-type: none"> • Right Triangles • Triangles • Compound Plane Figures (Consisting of two figures from Triangles/ Right Triangles/ Squares/ Rectangles) • Surface Area <ul style="list-style-type: none"> • Cubes • Cuboids | <p>05</p> |
| <p>Competency – 9 Fulfills daily requirements by working with an awareness of mass.</p> <p>9.1 Facilitates daily work by investigating large masses.</p> | <ul style="list-style-type: none"> • Mass <ul style="list-style-type: none"> • Relationship between Kilogram and Metric Ton • Kilogram ↔ Metric Ton • Problems related to Mass (Including Metric Ton) | <p>05</p> |
| <p>Competency – 10 Gets the maximum out of space by working critically with respect to volume.</p> <p>10.1 Determines for daily needs, the space that is taken up by various solids.</p> | <ul style="list-style-type: none"> • Formulae related to Volume <ul style="list-style-type: none"> • Cube • Cuboid | <p>05</p> |

| Competencies, Competency Levels | Subject Content | Periods |
|---|---|-----------|
| <p>Competency – 11 Fulfills daily needs by working critically with the knowledge of liquid measures.</p> <p>11.1 Facilitates daily work by investigating the capacity of liquid containers.</p> | <ul style="list-style-type: none"> • Capacity <ul style="list-style-type: none"> • Defining Capacity • Relationship between Volume and Capacity • Estimation of Capacity • Problems related to Capacity | <p>04</p> |
| <p>Competency – 12 Fulfills the needs of the world of work by time management.</p> <p>12.1 Investigates the rotation of the earth and inquires into its results.</p> <p>12.2 Investigates the difference in time between countries and finds their relative positions.</p> | <ul style="list-style-type: none"> • Time Zones <ul style="list-style-type: none"> • Defining Time Zones • Time at a Certain Location with respect to Standard Time | <p>06</p> |
| <p>Competency – 13 Uses scale drawings in practical situations by exploring various methods.</p> <p>13.1 Indicates the direction of a location using angles.</p> <p>13.2 Describes various locations in the environment using scale drawings.</p> | <ul style="list-style-type: none"> • Location <ul style="list-style-type: none"> • In terms of a Main Direction • In terms of Bearings • Describing Scale Drawings <ul style="list-style-type: none"> • Scale as a Ratio • Sketching Scale Drawings | <p>11</p> |

| Competencies, Competency Levels | Subject Content | Periods |
|--|--|-----------|
| <p>Competency – 14 Simplifies algebraic expressions by systematically exploring various methods.</p> <p>14.1 Simplifies algebraic expressions by removing brackets and finds the value by substitution.</p> | <ul style="list-style-type: none"> • Algebraic Expressions <ul style="list-style-type: none"> • Construction and Simplification (With addition, subtraction and brackets) • Substitution (Integers) | <p>05</p> |
| <p>Competency – 15 Factorizes algebraic expressions by systematically exploring various methods.</p> <p>15.1 Factorizes algebraic expressions.</p> | <ul style="list-style-type: none"> • Factors of Algebraic Expressions with Three Terms <ul style="list-style-type: none"> • Common Factor is a Whole Number • Common Factor is an Algebraic Term | <p>05</p> |
| <p>Competency – 17 Manipulates the methods of solving equations to fulfill the needs of day to day life.</p> <p>17.1 Uses linear equations to solve problems.</p> | <ul style="list-style-type: none"> • Constructing Linear Equations <ul style="list-style-type: none"> • For Real Situations • Solving Linear Equations <ul style="list-style-type: none"> • Including Fractions as Coefficients and with one Bracket | <p>06</p> |
| <p>Competency – 18 Analyzes the relationships between various quantities related to real-life problems.</p> | | <p>05</p> |

| Competencies, Competency Levels | Subject Content | Periods |
|---|--|-----------|
| <p>18.1 Uses the relationships between two quantities to solve problems.</p> <p>Competency – 20 Easily communicates the mutual relationships that exist between two variables by exploring various methods.</p> <p>20.1 Uses a number line to represent fractions and decimal numbers.</p> <p>20.2 Illustrates the behavior of a variable pictorially.</p> <p>20.3 Represents location on a Cartesian Plane.</p> | <ul style="list-style-type: none"> • Solving Inequalities <ul style="list-style-type: none"> • $x \pm a \geq b$ ($a, b \in Z$) • $ax \begin{matrix} < \\ \geq \\ < \end{matrix} b$ ($a, b \in Z, a \neq 0$) • Representation of the Solutions on a Number Line • Representation of Points on a Number Line <ul style="list-style-type: none"> • Fractions and Decimals • Representation of Ranges on a Number Line <ul style="list-style-type: none"> • $x > a, x < a$ • $x \geq a, x \leq a$ • $a \leq x \leq b$ • Representation on a Cartesian Plane <ul style="list-style-type: none"> • Ordered Pairs of Integers (In all four quadrants) • Graphs of Equations of the form $x = a, y = b$ | <p>06</p> |
| <p>Competency – 21 Makes decisions by investigating the relationships between various angles.</p> <p>21.1 Examines the angles made by various straight lines.</p> | <ul style="list-style-type: none"> • Angles made by a Transversal Intersecting Two Straight Lines (non parallel lines) <ul style="list-style-type: none"> • Alternate Angles • Corresponding Angles • Allied Angles | <p>06</p> |

| Competencies, Competency Levels | Subject Content | Periods |
|--|--|---------|
| <p>21.2 Performs calculations using the relationships between various angles.</p> <p>Competency – 22 Creates new models by exploring various solids.</p> | <ul style="list-style-type: none"> • Defining Angles and Performing Calculations related to these Angles <ul style="list-style-type: none"> • Adjacent Angles • Complementary Angles • Supplementary Angles • Vertically Opposite Angles • Calculating the Size of an Angle <ul style="list-style-type: none"> • Angles on a straight line • Angles around a point | 05 |
| <p>22.1 Creates solids and confirms the relationships between properties.</p> <p>Competency – 23 Makes decisions regarding day to day activities based on geometrical concepts related to rectilinear plane figures.</p> | <ul style="list-style-type: none"> • Solids (Models) <ul style="list-style-type: none"> • Octahedron • Dodecahedron • Verification of Euler's Relationship <ul style="list-style-type: none"> • Octahedron • Dodecahedron • For solids with only straight edges, such as icosahedrons | 06 |
| <p>23.1 Inquires into the relationships between the various angles of rectilinear plane figures.</p> | <ul style="list-style-type: none"> • Drawing and Measuring the Interior and Exterior Angles of Rectilinear Plane Figures <ul style="list-style-type: none"> • Triangle • Quadrilateral • Calculating Exterior Angles using Interior Angles <ul style="list-style-type: none"> • Triangle • Quadrilateral | |

| Competencies, Competency Levels | Subject Content | Periods |
|---|---|---------|
| <p>Competency – 24 Thinks logically to make decisions based on geometrical concepts related to circles.</p> <p>24.1 Inquires into the special properties related to circles.</p> | <ul style="list-style-type: none"> • Circle <ul style="list-style-type: none"> • Chord • Sector • Segment • Symmetric Properties | 05 |
| <p>Competency – 25 Observes the beauty of the environment by exploring the properties of various shapes.</p> <p>25.1 Inquires into the results of a rotation that are based on symmetry.</p> | <ul style="list-style-type: none"> • Rotational Symmetry <ul style="list-style-type: none"> • Concept • Centre of Symmetry • Order of Symmetry (For Geometrical Shapes only) | 04 |
| <p>Competency – 26 Investigates the methods of organizing various geometrical shapes and uses them to enhance beauty.</p> <p>26.1 Studies shapes by creating various patterns that can be used to enhance beauty.</p> | <ul style="list-style-type: none"> • Semi-pure Tessellation (Including Triangles and Quadrilaterals) | 04 |
| <p>Competency – 27 Analyzes according to geometric laws, the nature of the locations in the surroundings.</p> | | 06 |

| Competencies, Competency Levels | Subject Content | Periods |
|--|--|---------|
| <p>27.1 Compares various movements with the basic loci.</p> <p>27.2 Constructs Triangles.</p> | <ul style="list-style-type: none"> • Defining the Basic Loci <ul style="list-style-type: none"> • Of a point a constant distance from a fixed point • Of a point a constant distant from a fixed straight line • Of a point equidistant from two intersecting straight lines • Of a point equidistant from two points. (without construction) • Construction of Triangles (When the lengths of the sides are given) | |
| <p>Competency – 28 Facilitates daily work by investigating the various methods of representing data.</p> | | 06 |
| <p>28.1 Represents data such that comparison is facilitated.</p> | <ul style="list-style-type: none"> • Representation <ul style="list-style-type: none"> • Pie Charts • Tables (Ungrouped Data) | |
| <p>Competency – 29 Makes predictions by analyzing data by various methods to facilitate daily activities.</p> | | |
| <p>29.1 Inquires into numerical representative values of a group of data.</p> | <ul style="list-style-type: none"> • Central Tendency Measurements (Ungrouped Data) <ul style="list-style-type: none"> • Mode • Median • Mean • Measurements related to the Spread (Ungrouped Data) <ul style="list-style-type: none"> • Range | |

| Competencies, Competency Levels | Subject Content | Periods |
|---|---|---------|
| <p>Competency – 30 Manipulates the principles related to sets to facilitate daily activities.</p> <p>30.1 Analyses the various relationships related to sets.</p> | <ul style="list-style-type: none"> • Set Notations <ul style="list-style-type: none"> • Writing the elements within twin brackets • Is an element (\in) • Is not an element (\notin) • Universal Set (ε) • Empty Set (\emptyset) • Number of Elements ($n(A)$) | 04 |
| <p>Competency – 31 Analyzes the likelihood of an event occurring to predict future events.</p> <p>31.1 Determines the likelihood of an event occurring by investigating the various methods of finding a suitable value.</p> | <ul style="list-style-type: none"> • Suitable Values for the Likelihood of an Event <ul style="list-style-type: none"> • Fraction of Success • Experimental Probability • Theoretical Probability | 05 |

Grade 8 - Mathematics

Relationship between Subject Themes and Content

| Content | Learning Outcomes |
|--|---|
| <p>Numbers</p> <p>1.1 Whole Numbers</p> <ul style="list-style-type: none"> • Square • Square Root <p>1.2 Integers</p> <ul style="list-style-type: none"> • Subtraction • Multiplication • Division <p>Directed Numbers</p> <ul style="list-style-type: none"> • Subtraction • Multiplication • Division <p>2.1 Common Term of Number Patterns</p> <ul style="list-style-type: none"> • Square Numbers • Triangular Numbers • Odd Numbers • Even Numbers • Patterns from Multiples of Numbers <p>3.1 Multiplying Fractions</p> <ul style="list-style-type: none"> • Whole Number by a Fraction • Fraction by a Fraction • Fraction by a Mixed Number • Mixed Number by a Mixed Number | <ul style="list-style-type: none"> • Finds the square of a whole number. (1 – 20) • Finds the square root of a perfect square by observation and by using prime factors. (1 – 1000) • Subtracts integers. • Multiplies integers. • Divides integers. • Subtracts directed numbers. • Multiplies directed numbers. • Divides directed numbers. • Writes the common term of patterns of square numbers. • Writes the common term of patterns of triangular numbers. • Writes the common term of patterns of odd numbers. • Writes the common term of patterns of even numbers. • Writes the common term of various sequences of numbers. • Multiplies a whole number by a fraction. • Multiplies a fraction by a fraction. • Multiplies a fraction by a mixed number. • Multiplies a mixed number by a mixed number. |

| Content | Learning Outcomes |
|---|--|
| <p>3.2 Dividing Fractions</p> <ul style="list-style-type: none"> • Reciprocal of a Whole Number • Reciprocal of a Fraction • Whole Number by a Fraction • Fraction by a Fraction • Fraction by a Mixed Number • Mixed Number by a Mixed Number <p>3.3 Decimals</p> <ul style="list-style-type: none"> • Multiplication • Division <p>4.1 Dividing into a Ratio</p> <ul style="list-style-type: none"> • With respect to Money and Time • The Total Amount when a Ratio is given <p>4.2 Compound Ratios</p> <p>5.1 Percentages</p> <ul style="list-style-type: none"> • Fractions as Percentages • Ratios as Percentages <p>5.2 Solving Problems</p> <ul style="list-style-type: none"> • Percentage of a Quantity • Quantity when a Percentage is given | <ul style="list-style-type: none"> • Writes the reciprocal of a whole number. • Writes the reciprocal of a fraction. • Divides a whole number by a fraction. • Divides a fraction by a fraction. • Divides a fraction by a mixed number. • Divides a mixed number by a mixed number. • Multiplies a whole number by a decimal number. • Multiplies a decimal number by a decimal number. • Divides a whole number by a decimal number. • Divides a decimal number by a decimal number. • Divides a quantity into a ratio with respect to money and time. • Finds the total amount when a ratio is given. • Solves problems by writing a compound ratio as a common ratio. (Using equivalent ratios) • Writes a fraction as a percentage. • Writes a ratio as a percentage. • Calculates a percentage of a quantity. • Solves problems by finding the total amount when a percentage is given. |

| Content | Learning Outcomes |
|--|---|
| <p>6.1 Indices and Logarithm</p> <ul style="list-style-type: none"> • Powers of a Product <p>6.2 Power of a Negative Integer.</p> <p>Measurements</p> <p>7.1 Perimeter</p> <ul style="list-style-type: none"> • Compound Plane Figures <p>8.1 Area</p> <ul style="list-style-type: none"> • Right Triangles • Triangles • Compound Plane Figures <p>8.2 Surface Area</p> <ul style="list-style-type: none"> • Cube • Cuboid <p>9.1 Mass</p> <ul style="list-style-type: none"> • Units • Conversion • Solving Problems <p>10.1 Volume</p> <ul style="list-style-type: none"> • Cube • Cuboid | <ul style="list-style-type: none"> • Expands and writes the power of a product $(ab)^n = a^n b^n$ ($n \leq 3$) • Expands and writes the value of a power of a negative integer. (Index 1 - 4) • Finds the perimeter of compound plane figures consisting of two figures from equilateral triangles, isosceles triangles, squares and rectangles. • Finds the area of right triangles. • Finds the area of triangles. • Finds the area of compound plane figures consisting of two figures from right triangles, triangles, squares and rectangles. • Finds the surface area of a cube. • Finds the surface area of a cuboid. • Recognizes the relationship between Kilograms and Metric Tons. • Converts ($kg \leftrightarrow t$). • Solves problems in day to day life related to metric tons. • Finds the volume of a cube using the formula. • Finds the volume of a cuboid using the formula. |

| Content | Learning Outcomes |
|---|--|
| <p>11.1 Capacity</p> <ul style="list-style-type: none"> • Concept • Comparison • Estimation • Solving Problems <p>12.1 Time Zones</p> <p>12.2 Local Time and Standard Time</p> <p>13.1 Location</p> <ul style="list-style-type: none"> • In terms of a Main Direction • In terms of Bearings <p>13.2 Explaining Scale Drawings</p> <ul style="list-style-type: none"> • Scale as a Ratio • Drawing to Scale <p>Algebra</p> <p>14.1 Algebraic Expressions</p> <ul style="list-style-type: none"> • Construction and Simplification • Substitution <p>15.1 Common Factors</p> | <ul style="list-style-type: none"> • Recognizes capacity as the quantity of liquid required to fill a vessel completely. • Recognizes the difference between volume and capacity. • Estimates capacity. • Solves problems related to capacity. • Identifies time zones. • Writes the time at various locations in different countries by comparing local time with standard time. • Represents the direction of a location in terms of the main directions. • Represents the direction of a location in terms of bearing. • Represents the scale as a ratio. • Makes scale drawings of various rectilinear plane figures. • Constructs and simplifies algebraic expressions with brackets • Finds the value of an algebraic expression by substituting integers. • Factors out the common factors of algebraic expressions with three terms. (Common factor is a whole number/ an algebraic term) |

| Content | Learning Outcomes |
|--|--|
| <p>17.1 Linear Equations</p> <ul style="list-style-type: none"> • Construction • Solving <p>18.1 Inequalities</p> <ul style="list-style-type: none"> • Solving • Representation <p>20.1 Representation of points on a number line</p> <ul style="list-style-type: none"> • Fractions and decimals <p>20.2 Representation of Ranges on a Number Line</p> <p>20.3 Representation of points on a Cartesian plane</p> <ul style="list-style-type: none"> • Ordered Pairs of Integers • Graphs <p>Geometry</p> <p>21.1 Angles</p> <ul style="list-style-type: none"> • Alternate Angles • Corresponding Angles • Allied Angles | <ul style="list-style-type: none"> • Constructs linear equations for real situations. • Solves linear equations. (With fractions as coefficients and with one bracket) • Solves inequalities. (Of the form $x \pm a \leq b$ and $ax \leq b$) ($a, b \in \mathbb{Z}, a \neq 0$) • Represents solutions of inequalities on a number line. • Represents fractions and decimals on a number line. • Represents ranges on a number line ($x > a, x < a, x \geq a, x \leq a, a \leq x \leq b$). • Represents ordered pairs of integers on a Cartesian plane. (All four quadrants) • Sketches graphs of equations of the form $x = a, y = b$. • Identifies alternate, corresponding and allied angles made by a transversal intersecting two non parallel straight lines. |

| Content | Learning Outcomes |
|---|--|
| <p>21.2 Calculations related to Angles</p> <ul style="list-style-type: none"> • Adjacent Angles • Complementary Angles Supplementary Angles • Angles on a straight line • Vertically Opposite Angles • Angles around a point <p>22.1 Solids</p> <ul style="list-style-type: none"> • Octahedron • Dodecahedron • Euler's Relationship for Solids <p>23.1 Drawing, Measuring and Calculating the Exterior and Interior Angles of Rectilinear Plane Figures</p> <ul style="list-style-type: none"> • Triangle • Quadrilateral <p>24.1 Circle</p> <ul style="list-style-type: none"> • Chord • Sector • Segment • Symmetric Properties | <ul style="list-style-type: none"> • Performs calculations related to adjacent angles. • Performs calculations related to supplementary angles, complementary angles. • Performs calculations related to angles on a straight line. • Performs calculations related to vertically opposite angles. • Performs calculations related to angles around a point. • Makes a model of an octahedron and a dodecahedron and inquires into their properties. • Confirms Euler's relationship using the amounts of various properties of solids such as the octahedron, dodecahedron which have only straight edges. • Draws exterior angles by producing the sides of triangles and quadrilaterals. • Measures interior angles and exterior angles. • Calculates exterior angles using interior angles. • Identifies the chord, sector, segment and symmetric properties of a circle. |

| Content | Learning Outcomes |
|--|---|
| <p>25.1 Rotational Symmetry</p> <ul style="list-style-type: none"> • Concept • Centre of Symmetry • Order of Symmetry <p>26.1 Tessellation</p> <ul style="list-style-type: none"> • Semi-pure Tessellation <p>27.1 Loci</p> <ul style="list-style-type: none"> • Of a point a constant distance from a fixed point • Of a point a constant distance from a fixed straight line • Of a point equidistant from two intersecting straight lines • Of a point equidistant from two points. <p>27.2 Triangles</p> <ul style="list-style-type: none"> • Construction <p>Statistics</p> <p>28.1 Representation of Data</p> <ul style="list-style-type: none"> • Pie Charts • Tables <p>29.1 Representative Values</p> <ul style="list-style-type: none"> • Mode • Median • Mean • Range | <ul style="list-style-type: none"> • Understands the concept of rotational symmetry. • Identifies the centre of symmetry and the order of symmetry. (For symmetric geometrical shapes only) • Creates semi-pure tessellations that include triangles and quadrilaterals. • Draws the locus of a point a constant distance from a fixed point. • Draws the locus of a point a constant distance from a fixed straight line. • Draws the locus of a point equidistant from two intersecting straight lines. • Draws the locus of a point equidistant from two points. (Without construction). • Constructs triangles when the lengths of the sides are given. • Represents data by pie charts. • Represents data in tables without class intervals. • Finds the mode of a set of ungrouped data. • Finds the median of a set of ungrouped data. • Calculates the mean of a set of ungrouped data. • Finds the range of a set of ungrouped data. |

| Content | Learning Outcomes |
|---|---|
| <p>Sets and Probability</p> <p>30.1 Set Notations</p> <ul style="list-style-type: none"> • Is an element • Is not an element • Universal Set • Empty Set (\emptyset) • Number of Elements ($n(A)$) <p>31.1 Probability</p> <ul style="list-style-type: none"> • Fraction of Success • Experimental Probability • Theoretical Probability | <ul style="list-style-type: none"> • Identifies symbols related to sets (\in, \notin, ε). • Describes the properties of the empty set. • Writes down the number of elements in a set. • Represents the likelihood of an event occurring in terms of the fraction of success. • Finds the experimental probability of an event. • Calculates the theoretical probability of an event. |

Grade 8 – Teaching Sequence

| Lesson | Competency Levels | Number of Periods |
|---|-------------------|-------------------|
| Term 1 | | |
| 01 Number Patterns | 2.1 | 5 |
| 02 Perimeter | 7.1 | 5 |
| 03 Angles | 21.1, 21.2 | 5 |
| 04 Directed Numbers | 1.2 | 5 |
| 05 Algebraic Expressions | 14.1 | 5 |
| 06 Solids | 22.1 | 5 |
| 07 Factors | 15.1 | 5 |
| 08 Square Root | 1.1 | 5 |
| 09 Mass | 9.1 | 5 |
| 10 Indices | 6.1, 6.2 | 5 |
| Term 2 | | |
| 11 Symmetry | 25.1 | 4 |
| 12 Triangles | 23.1 | 6 |
| 13 Fractions I | 3.1 | 6 |
| 14 Fractions II | 3.2 | 6 |
| 15 Decimals | 3.3 | 6 |
| 16 Ratios | 4.1, 4.2 | 5 |
| 17 Equations | 17.1 | 5 |
| 18 Percentages | 5.1, 5.2 | 6 |
| 19 Sets | 30.1 | 5 |
| 20 Area | 8.1, 8.2 | 5 |
| 21 Time | 12.1, 12.2 | 6 |
| Term 3 | | |
| 22 Volume and Capacity | 10.1, 11.1 | 5 |
| 23 Circle | 24.1 | 5 |
| 24 Location | 13.1 | 7 |
| 25 Number Line and Cartesian Plane | 20.1, 20.2, 20.3 | 6 |
| 26 Loci and Constructions | 27.1, 27.2 | 6 |
| 27 Representation of Data and Representative Values | 28.1, 29.1 | 6 |
| 28 Scale Drawings | 13.2 | 5 |
| 29 Inequalities | 18.1 | 4 |
| 30 Probability | 31.1 | 4 |
| 31 Tessellation | 26.1 | 5 |
| | | <u>168</u> |

School Policies and Programmes

The mathematics syllabus has been prepared not only with the objective of inculcating knowledge and skills but also to highlight the deeper aims of communication, relationships, logical argument and problem solving. The latterly mentioned four aims aid more effectively in the development of behavioral and thinking skills. Mathematics is a subject that should not be restricted to just the syllabus or the classroom. It should be made into an active force within the school culture itself as it is a language; a science; an art; a tool to be used in thought, in calculations and in creations.

It is important therefore to organize school programmes so that the cultural values embedded in mathematics are developed in students. The following co-curricular programmes will aid in this.

1. Wall newspapers
2. Mathematics Laboratory
3. Mathematics Library
4. Exhibitions
5. Mathematics Societies
6. Quizzes
7. Mathematics Magazines
8. Mathematics Days
9. Mathematics Camps
10. Activity Cells
11. Excursions

In operating this co-curricular programme, the school management should aim at obtaining the help of the community when required and also getting experts to teach some of the subject content.

If your school does not have a trained mathematics teacher for this grade, it is appropriate to engage a teacher who has the required subject knowledge and a penchant for teaching mathematics for this task. Mathematics teacher should continuously update their knowledge on subject material and teaching methodologies. For this, it is appropriate to get advice from the zonal mathematics director/ mathematics in-service advisors and senior graduate teachers. It is also necessary to participate in training sessions.

It is hoped that the school management will work towards allocating one of the free periods in the time table under the new reforms, for mathematics.

It is most likely that it will not be possible to complete a proposed exploration activity within a period, due to most activities being longer than 40 minutes. In such instances, the next mathematics period should be used to complete the activity.

To facilitate the tasks of the students as well as the teacher, chairs should be placed in a semi-circle during exploration activities. The quality inputs required for the activities are given under each activity in the chapter on learning teaching methodology. It would be easier to buy all the quality inputs for the year at once at the beginning of the year.

In guiding the learning teaching process, it is important to provide instructions by paying special attention to the following:

- Determining whether the students are engaged in exploration according to the E-5 model
- Carrying out assessment and evaluation at the appropriate times

It is also expected that attention will be paid to the following, which are proposed as remedies to the problems encountered when the competency based syllabi were operated in the school system in year 2007 in grades 6 and 10.

- Groups should be organized according to the number of students in the class. (If tasks have been assigned for 4 groups, the number of groups should be taken as a multiple of this number, depending on how many more/less students are in the class).
- The tasks in the instruction leaflet on exploration should be distributed randomly among the groups.
- Instead of appointing a leader, the opportunity should be provided for a person within the group itself to volunteer to be the leader.
- Students should first be engaged in the exploration process, and once the relevant mathematical concepts have been grasped through this process, the remaining time should be used for exercises.
- When a review is being done after the exploration process is concluded, students should be provided with the opportunity to write a summarized note on the lesson in their exercise books.
- Depending on the number of evaluations that should be carried out in a term, apart from the instruments for the extension of the learning – teaching process, to carry out the evaluations, appropriate activities should be selected and marks should be allocated.

Learning – Teaching Methodology

Introduction

In deciding upon the learning teaching methodology relevant to the course, attention has been paid to the planning of learning-teaching activities that facilitate building up of student competencies based on exploration. In preparing for a competency-based education of this manner, an obvious change in the role of the teacher is expected.

The transmission role practiced in our classroom from way back and the more recently introduced transaction role is evident in the classroom even today. When taking into consideration the deterioration of the thinking, social and personal skills of school leavers, no effort is needed to understand that there is a need for the development of the learning-teaching methodology and how it should be effected.

In the transmission role, the teacher is considered an individual who knows everything that the student should learn, and his task is that of transmitting knowledge to the student who is considered as one who does not know anything. This learning-teaching process that takes the guise of lectures is restricted only to the flow of knowledge from the teacher to the student, and does not make an adequate contribution either to the stimulation of student thinking or to the development of his personal and social skills.

The dialogue initiated by the teacher within the class is the initial stage of the transaction role. Apart from the ideas that flow from the teacher to the class and from the class to the teacher, as a result of the student-student interactions that takes place subsequently, these dialogues transform gradually into discussions. The teacher is continuously involved in the task of questioning in order to take the student from the known to the unknown, from the simple to the complex and from the concrete to the abstract.

While, in competency-based education, student tasks occupy a powerful position, the teacher takes on the role of a resource person who mediates in order to provide every student in the class with a competency that is at least proximate to the required competency. For this, the basic functions that the teacher is expected to perform include initiating the activity in a manner that will kindle interest, planning the learning environment with the necessary materials and other facilities, closely observing how students learn, identifying student abilities and inabilities and promoting student learning through the provision of feedback and feed-forward, paying close attention to student presentations and discussions, as well as preparing instruments for the extension of learning beyond the classroom. The teacher's role based essentially upon the tasks mentioned above is called the transformation role.

The series of activities that can be used in the implementation of the descriptive curriculum introduced in the first part of this teacher's instructional manual, has been included in its second part. Each of these activities has been developed so as to contain a minimum of three steps. It is expected to get the student involved in the learning process through the first step of the activities. Therefore, this step is termed the "engagement" step. As an introduction to this step, the teacher assumes the transaction role and engages in a

dialogue with the students. Subsequently, along with the transformation of this dialogue to a discussion, the students engage in exploration and are provided the opportunity to recall the pre-knowledge related to the basic competency they should develop, and to acquire a hint regarding the future of the activity. The teacher possesses a host of strategies that can be used in these exchanges of ideas. Some of the devices at the disposal of the teacher for the exchange of these ideas are questions/stimulants like pictures, newspaper advertisements and flash cards/puzzles or case studies/dialogues, role play, poems, songs and demonstrations, video tapes or audio tapes. In summary, the first step of the activities is implemented with the aim of actualizing the following three objectives.

- Winning over of the attention of the class.
- Providing the students with the opportunity for students' recall of the necessary pre-knowledge.
- Introducing the elements of the exploration the students are expected to be directed to under the second step of the activity.

It is with the objective of providing the students with the opportunity for exploration that the second step of the activity has been planned. Students base their exploration on a special leaflet prepared for the purpose. The teacher has to plan this step to enable the students to engage in co-operative learning in groups, through the exploration of various aspects of the problem. Two of the most important features of this step are the use of the resource materials provided and conscious involvement in group discussions. As a result of involvement in group activities throughout a long period of time, students will develop a number of essential skills like self-discipline, listening to others, working co-operatively with others, helping others, time management, producing high quality creations, honesty etc.

In directing students towards exploration, the teacher should avoid making decisions regarding leadership in the group, but he/she should prepare the background necessary for a leader to emerge. Accordingly, when opportune, the students will have the privilege of taking on leadership, based on inherent abilities.

During the 3rd step of the activity, every group will have the opportunity of presenting the results of its exploration for the enlightenment of the others. What the teacher has to do here is to encourage student involvement in group presentations. It would be effective if students are directed, so as to ensure that every member is given responsibility in the planning of the presentation. An important aspect of this step, related to the explanation of student findings, is the creation of the opportunity for the voice of students to be heard in the classroom, where commonly the voice of the teacher dominated.

After the explanation of the findings in the third step of the activities, students should be directed to elaboration. Each group is given the opportunity to provide constructive suggestions on its findings first, and subsequently, members of other groups are given this opportunity. Anyway, the final review is the responsibility of the teacher. During this review, the teacher is expected to clarify all the important points relevant to the students' exploration as well as to instill in students the right understanding of the concepts and rules.

The main responsibility of the teacher in this teaching methodology is to monitor continuously whether the classroom learning-teaching process is being implemented successfully and as expected. While assessment and evaluation should be made use of for this purpose, the teacher is provided the opportunity to carry this out, through planned activities, in the learning teaching process itself. The teacher is given the opportunity for assessment while the students are involved in exploration during the second stage of the activity and for evaluation when the students are involved in explanation and elaboration during the third stage. A detailed inquiry into assessment and evaluation will be provided later on in this document.

The teacher is provided direction on the transformation role by the learning – teaching methodology described so far. While priority is given to group exploration here, the teacher is also afforded the opportunity for transaction, discussion and short lectures. While there is room for transaction and discussion in the initial stage, the teacher may also give a short lecture to confirm the concepts, under review, in the final stage. In the development of the learning-teaching methodology related to this curriculum, the first to be introduced under the curriculum reforms for the new millennium, the attention paid to the important aspects of the transmission and the transaction roles of the teacher, apart from the transformation role, is a special feature of this methodology.

Activity Continuum

1. Number Patterns

Competency 02 : Makes decisions for future requirements by investigating the various relationships in number patterns.

Competency Level 2.1 : Builds relationships between the terms of number patterns by investigating various properties.

Activity 2.1 : Let us determine the common term of number patterns.

Time : 90 minutes.

Quality Inputs : • Four copies of the instruction leaflet on exploration included in Annex 2.1.1.
• Demy papers and pastels.

Learning –Teaching Process:

Step 2.1.1 : • Inquire from the students about the properties of even numbers, odd numbers, triangular numbers and square numbers.
• Lead a discussion and highlight the following facts.

- That numbers which can be divided by two without remainder are defined as **even numbers**
- That numbers which have a remainder of one when divided by two are defined as **odd numbers**
- That numbers such as 1, 3, 6, 10, which can be represented by triangular patterns are defined as **triangular numbers**
- That numbers such as 1, 4, 9, 16, which can be represented by square patterns are defined as **square numbers**
- That number types can be identified based on the common features of the numbers
- That when a group of numbers which have common features is organized in order, it is a number pattern

(20 minutes)

Step 2.1.2 : • Divide the class into four small groups.
• Distribute the instructions on exploration, demy papers and pastels among the groups.
• Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
• Engage the small groups in exploration.
• Let the groups prepare for presentations at the plenary session.

(30 minutes)

Step 2.1.3

- : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That by identifying the relationships between the terms of the number pattern, the forward terms can be obtained
- That the general term of a number pattern is determined by the relationship between the terms of the pattern and the position of the term
- That the general term (n^{th} term) of the natural numbers pattern is n
- That the n^{th} term of the even numbers pattern which begins with 2 is $2n$
- That the n^{th} term of the odd numbers pattern which begins with 1 is $2n - 1$
- That the n^{th} term of the pattern of multiples of 3 which begins with 3 is $3n$
- That the n^{th} term of the square numbers pattern is n^2
- That the n^{th} term of the triangular numbers pattern is $\frac{n}{2}(n + 1)$
- That any term in the number pattern can be obtained from the n^{th} term

(40 minutes)

Criteria for Assessment and Evaluation:

- Writes down the next term in a number pattern by recognizing the relationship between the terms of the number pattern.
- Writes down the number pattern in terms of its terms, when the general term is given.
- Writes down the general term (n^{th} term) of a number pattern based on the relationship between the terms and the position of the term
- Determines relationships by investigating information.
- Makes decisions for future requirements based on relationships.

Annex 2.1.1

Instructions for group exploration

Let us find the general term of number patterns

- Study the number pattern in the following box.

| | | | | |
|----------------------|---|------------------------------|---|----|
| 8, 12, 16, | | | | |
| 1 st term | → | $\underline{1} \times 4 + 4$ | → | 8 |
| 2 nd term | → | $\underline{2} \times 4 + 4$ | → | 12 |
| 3 rd term | → | $\underline{3} \times 4 + 4$ | → | 16 |
| 8 th term | → | $\underline{8} \times 4 + 4$ | → | 36 |

- Focus your attention on the pair of number patterns assigned to your group from the pairs of number patterns given below.

| | |
|--|--|
| <p>Case I</p> <p>2, 4, 6, 8, 10,</p> <p>6, 8, 10, 12, 14,</p> | <p>Case II</p> <p>3, 6, 9, 12, 15,</p> <p>9, 12, 15, 18, 21,</p> |
| <p>Case III</p> <p>1, 3, 5, 7, 9,</p> <p>3, 4, 5, 6, 7,</p> | <p>Case IV</p> <p>1, 4, 9, 16, 25,</p> <p>10, 15, 20, 25, 30</p> |

- Investigate the relationship between the terms of the number pattern and write down the next two terms.
- With the aid of the relationship, write down one below the other how each term is formed; i.e., the first term in terms of 1, the second term in terms of 2, the third term in terms of 3 etc.
- Based the rows of numbers obtained above, write down the 9th term in terms of 9, the 10th term in terms of 10 and the n^{th} term in terms of n .
- As which term of the number pattern can you define the expression you obtained in terms of n ?
- Discuss the importance of the expression you obtained for the n^{th} term and present your ideas.
- Prepare for a presentation at the plenary session.

2. Perimeter

Competency 07 : Carries out daily tasks effectively by investigating the various methods of finding the perimeter.

Competency Level 7.1 : Satisfies various requirements by investigating the perimeter of rectilinear plane figures.

Activity 7.1 : Let us find the perimeter of compound plane figures.

Time : 105 minutes.

Quality Inputs :

- An enlarged copy of the illuminating question in Annex 7.1.1.
- Four copies of the instruction leaflet on exploration included in Annex 7.1.2.
- The following shapes cut out from thick cardboard (Bristol board).
 - 04, $10\text{ cm} \times 5\text{ cm}$ rectangles.
 - 04 squares with sides of length 5 cm each.
 - 08 equilateral triangles with sides of length 5 cm each.
 - 08 isosceles triangles with sides of length 5 cm , 8 cm and 8 cm .
- 4 red coloured pieces of twine of length 1 m each.
- 4 thick cardboard (Bristol board) pieces of dimension $25\text{ cm} \times 15\text{ cm}$.

Learning – Teaching Process:

Step 7.1.1 :

- Present the illuminating question to the class and seek solutions for it from the students.
- Based on the solutions, lead a discussion and highlight the following facts on the perimeter of plane figures.

- That the length around a plane figure is its perimeter
- That the perimeter of a rectilinear plane figure is obtained by adding up the lengths of all its sides
- That the perimeter of a rectangle is also obtained by adding its length and breadth and multiplying the sum by two
- That the perimeter of a square is also obtained by multiplying the length of one of its sides by four
- That the perimeter of an equilateral triangle is also obtained by multiplying the length of a side of the triangle by three

(15 minutes)

Step 7.1.2

- : • Divide the class into four small groups.
- Distribute the instructions on exploration, two quadrilateral shapes of the same type, four triangles of the same type, a piece of twine and a piece of thick cardboard each among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for presentations at the plenary session.

(50 minutes)

Step 7.1.3

- : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That a compound plane figure is formed by the combination of several plane figures
- That the perimeter of a compound figure is the length around it
- That some of the sides of the figures that make up the compound plane figure are not sides of the compound figure
- That the perimeter of the compound plane figure need not be equal to the sum of the perimeters of the plane figures it is made up of

(40 minutes)

Criteria for Assessment and Evaluation:

- Determines the perimeter of compound plane figures that consist of two of the shapes rectangle, square, equilateral triangle and isosceles triangle, with each shape being included just once.
- Determines the perimeter of compound plane figures that consist of two of the above shapes, with one of the shapes being included twice.
- Determines the perimeter of any compound plane figure containing the above shapes.
- Engages in making attractive creations by having an understanding of the perimeter.
- Uses resources carefully, by making plans.

Annex 7.1.1

Illuminating Question

The paddy field should be protected from birds for at least a week after the seeds are sown

- A child who is chasing birds, runs around a rectangular shaped paddy field of length 100 m and breadth 50 m , once per hour. What is the total distance he has run in completing one round?
- If he runs once around another field that is square shaped with sides of length 75 m each, what would be the total distance he has run around the field?
- If the two fields are joined together, what would be the distance the child would have to run to complete one round?

Annex 7.1.2

Instructions for group exploration

Let us find the perimeter of compound plane figures

| | |
|-------------------------------|---|
| Collection of shapes 1 | 02 rectangles, 04 equilateral triangles |
| Collection of shapes 2 | 02 squares, 04 equilateral triangles |
| Collection of shapes 3 | 02 rectangles, 04 isosceles triangles |
| Collection of shapes 4 | 02 squares, 04 isosceles triangles |

- Focus your attention on the measurements of the shapes in the collection received by your group from the above collections and note down the perimeter of each shape.
- Construct a new compound plane figure using at least two distinct shapes and such that the shapes do not overlap with each other, and paste it on the thick cardboard.
- Measure the length of the given piece of twine, and make the compound figure you created attractive by pasting the twine once around the edge of the figure.
- Measure the length of the remaining piece of twine and based on it, determine the perimeter of the compound figure.
- Propose a method that can be used to calculate the perimeter of the compound figure.
- Is the perimeter of the compound figure equal to the sum of the perimeters of the shapes you used? Discuss the reasons for your answer.
- Using the given shapes, construct another compound figure, and calculate the perimeter using the method you proposed.
- Prepare to present your findings creatively at the plenary session.

3. Angles - I

Competency 21 : Makes decisions by investigating the relationships between various angles.

Competency Level 21.1 : Examines the angles made by various straight lines.

Activity 21.1 : Let us identify pairs of angles.

Time : 55 minutes.

Quality Inputs :

- An enlarged copy of the figure in Annex 21.1.1.
- Three copies of the instruction leaflet on exploration included in Annex 21.1.2.
- Three tissue papers the size of half-sheets.
- Straight edges.

Learning – Teaching Process:

Step 21.1.1 :

- Present the enlarged figure to the class and inquire from the students about the types of angles in the figure and about naming angles.
- Lead a discussion and highlight the following facts.

- That a 90° angle is a right angle
- That acute angles are less than 90°
- That obtuse angles are greater than 90°
- That an angle can be named using the English letters that have been used to name the arms of the angle
- That in a figure, simple letters are used to denote the size of an angle

(10 minutes)

Step 21.1.2 :

- Divide the class into three small groups.
- Distribute the instructions on exploration, tissue papers and straight edges among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for presentations at the plenary session.

(25 minutes)

Step 21.1.3

- : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That a straight line that cuts two or more straight lines is called a transversal
- That pairs of corresponding angles, alternate angles and allied angles are formed by a transversal cutting a pair of straight lines
- That the corresponding angles can be easily identified by the shape of the letter *F*, the alternate angles by the shape of the letter *Z* and the allied angles by the shape of the letter *C* formed by a transversal cutting a pair of straight lines

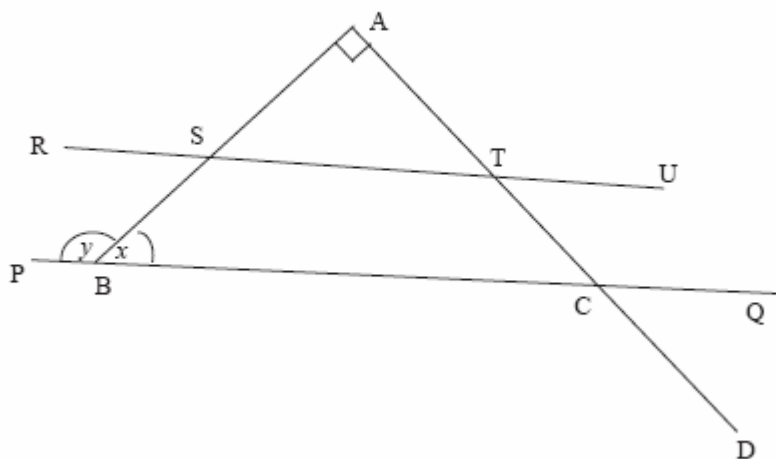
(20 minutes)

Criteria for Assessment and Evaluation:

- Names the various angles formed by a transversal cutting a pair of straight lines.
- Identifies, based on the shapes *Z*, *F* and *C*, and names, pairs of alternate angles, pairs of corresponding angles and pairs of allied angles formed by a transversal cutting a pair of straight lines.
- Classifies pairs of angles formed by a transversal cutting two straight lines as corresponding angles, alternate angles and allied angles.
- Comprehends facts through observation.
- Comes to conclusions logically.

Annex 21.1.1

Figure

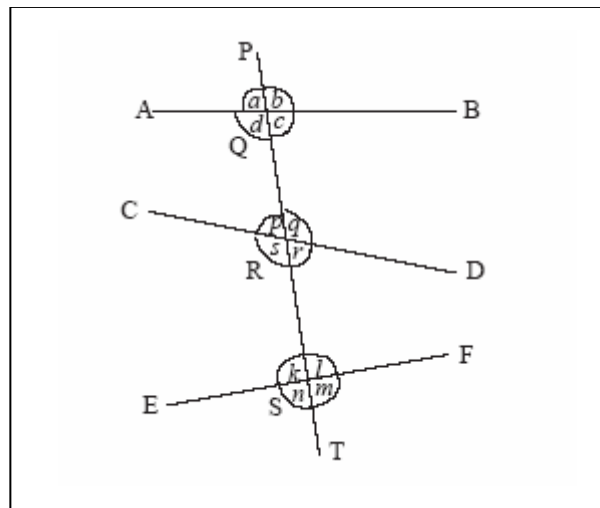
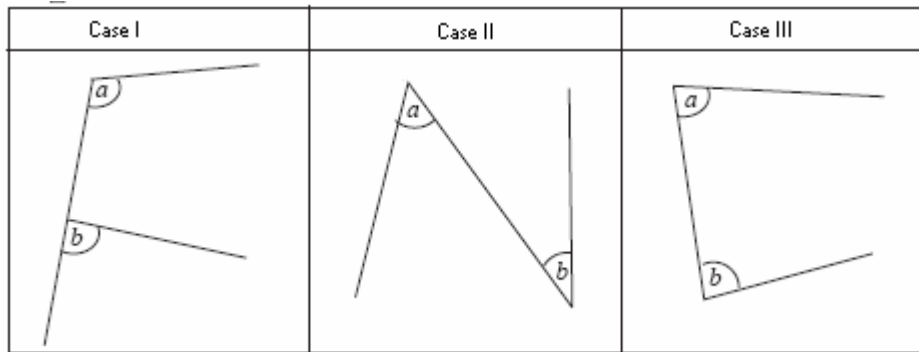


Annex 21.1.2

Instructions for group exploration

Let us identify pairs of angles

- Focus your attention on the case received by your group from the cases given below.



- Identify the location of the pair of angles marked in the shape received by your group.
- From the figure given above, copy on a piece of tissue paper, the pairs of angles that are in the shape received by your group.
- Write down on the tissue paper, the simple letters used for the angles relevant to that shape.
- Write the angles you noted down as pairs.
- In this manner, obtain at least 5 relevant pairs.
- By studying the textbook, propose a name to denote the pairs of angles obtained by your group.
- Discuss how appropriate the proposed name is based on the location of the angles.
- Propose a convenient method to remember the type of angles, by relating the shape of the pairs to the shape of an English letter.
- Prepare to present your findings creatively at the plenary session.

3. Angles - II

Competency 21 : Makes decisions by investigating the relationships between various angles.

Competency Level 21.2 : Performs calculations using the relationships between various angles.

Activity 21.2 : Let us identify angles; Let us find the values.

Time : 135 minutes.

Quality Inputs :

- An enlarged copy of the figure included in Annex 21.2.1.
- Three copies of the instruction leaflet on exploration included in Annex 21.2.2.
- Demy papers and pastels.

Learning – Teaching Process :

Step 21.2.1

- Present the figure to the class.
- Lead a discussion and highlight the following facts.

- That angles can be named using three Capital letters
- That the vertex of an angle can be identified
- That the arms that form an angle can be identified
- That two angles can be drawn with a common vertex and a common arm

(15 minutes)

Step 21.2.2

- Divide the class into three small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on part I of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let them prepare for a presentation at the plenary session.

(30 minutes)

Step 21.2.3

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That two angles which share a common vertex and a common arm and hence lie on the two sides of the common arm are called **adjacent angles**
- That the sum of two adjacent angles on a straight line equals 180°

(30 minutes)

Step 21.2.4

- : • Organize the groups again.
- Focus the attention of the groups on part II of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for presentations at the plenary session.

(30 minutes)

Step 21.2.5

- : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That a pair of angles which adds up to 90° is called complementary
- That a pair of angles which adds up to 180° is called supplementary
- That pairs of supplementary angles can be observed when straight lines intersect each other
- That pairs of complementary angles may be observed at certain instances when right angles are constructed,
- That pairs of vertically opposite angles are formed by the intersection of two straight lines and that these are equal to each other in size
- That the sum of the angles around a point equals 360°
- That various calculations can be performed based on pairs of supplementary, complementary, vertically opposite and adjacent angles

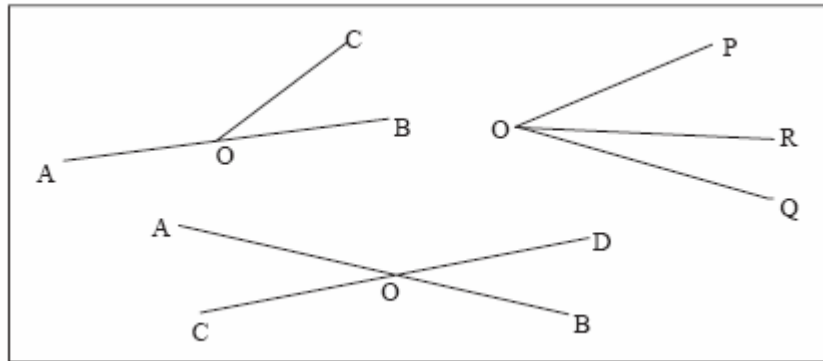
(30 minutes)

Criteria for Assessment and Evaluation:

- Names various angles based on their properties.
- Identifies and separates out pairs of complementary, supplementary, vertically opposite and adjacent angles in a given rectilinear plane figure.
- Engages in various calculations based on pairs of complementary, supplementary, vertically opposite and adjacent angles
- Comes to conclusions giving reasons.
- Investigates the presentations of the other groups.

Annex 21.2.1

Figure



Annex 21.2.2

Instructions for group exploration

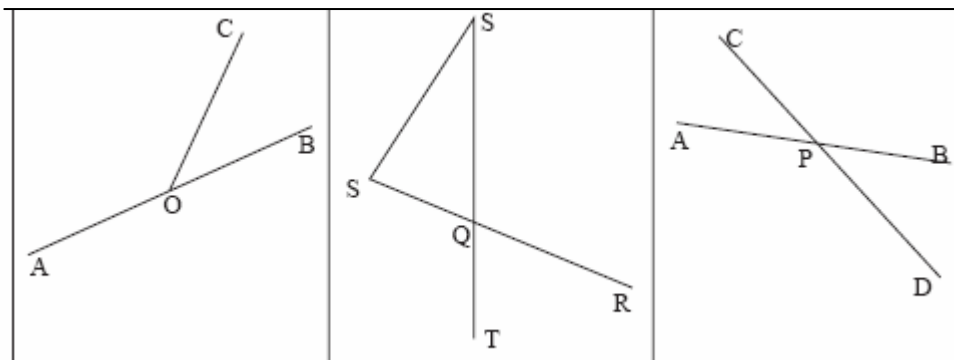
Let us identify angles; Let us find the values

Part I

Figure 1

Figure 2

Figure 3



- Focus your attention on the figure received by your group from the figures given above.
- Using capital letters, write down all the angles in the figure.
- Select and write the pairs of angles that share a common vertex and a common arm.
- Name the common vertex and the common arm of the pairs of angles.
- Propose a name that can be used for these pairs, based on the properties you identified.
- Write down pairs of angles that have a common vertex and a common arm and add up to 180° .
- Draw a pair of angles that adds up to 180° and is of the type you found. Using the protractor, determine the size of each angle and write it down.
- Calculate the value of the remaining angle. Now, by measuring the remaining angle using a protractor, examine the accuracy of the value you obtained.
- Explain how the above result can be used to obtain the sum of the angles around a point.
- Prepare to present your findings creatively at the plenary session.

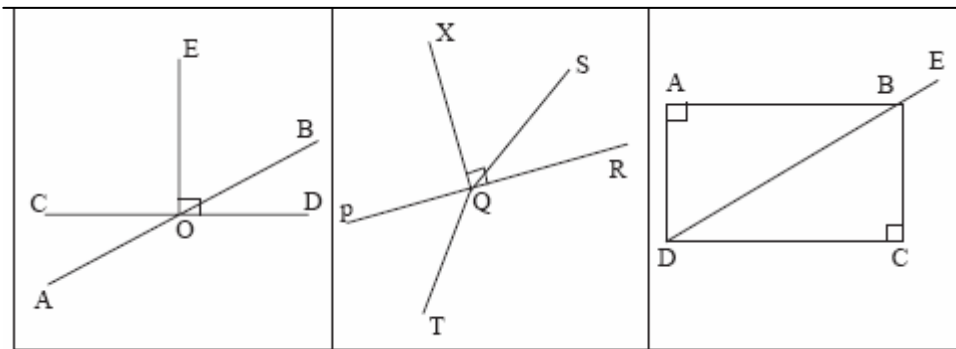
Part II

- *If the sum of two angles is 180° , then each angle is the supplement of the other.*
- *If the sum of two angles is 90° , then each angle is the complement of the other*

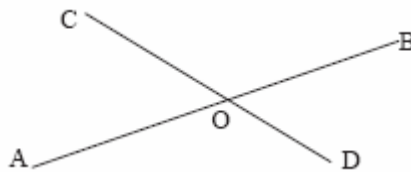
Figure 1

Figure 2

Figure 3



- Focus your attention on the figure received by your group from the figures given above.
- Write down the pairs of supplementary angles and complementary angles that can be observed.
- State the reasons why they are supplementary, complementary angles.



- Draw a figure similar to the above figure, measure the four angles in the figure using a protractor, and write them down.
- Thereby identify two pairs of angles that are of equal size.
- Propose a name for the pairs based on their positions.
- Construct a figure made up of straight lines that include all the types of angles that you identified above, and name them.
- Prepare to present your findings creatively at the plenary session.

4. Directed Numbers

Competency 01 : Manipulates the mathematical operations in the set of real numbers to fulfill the needs of day to day life.

Competency Level 1.2 : Manipulates directed numbers under the basic mathematical operations.

Activity 1.2 : Let us manipulate directed numbers under the mathematical operations.

Time : 135 minutes.

Quality Inputs : • Three copies of the instruction leaflet on exploration included in Annex 1.2.1.
• Demy papers and pastels.

Learning – Teaching Process:

Step 1.2.1 : • On the blackboard, using a number line, present several instances of the addition of two directed numbers.
• For each case, inquire from the students about the numbers that are added together and the solution that is obtained.
• Lead a discussion and highlight the following facts.

- That the sum of two directed numbers of identical sign is another directed number of the same sign
- That the sign of the sum of two directed numbers of distinct signs depends on the two numbers
- That the difference between two identical numbers is zero

(15 minutes)

Step 1.2.2 : • Divide the class into three small groups.
• Distribute the instructions on exploration, demy papers and pastels among the groups.
• Focus the attention of the groups on part I of the instructions on exploration and assign the relevant task to each group.
• Engage the small groups in exploration.
• Let the groups prepare for a presentation at the plenary session.

(35 minutes)

Step 1.2.3

- : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That subtracting a directed number from another directed number can be converted into an addition of directed numbers
- That subtracting a directed number means changing the sign (direction) of the number and adding it
- That simplification is facilitated by converting a subtraction into an addition

(30 minutes)

Step 1.2.4

- : • Organize the groups again.
- Focus the attention of the groups on part II of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the small groups prepare for presentations at the plenary session.

(25 minutes)

Step 1.2.5

- : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That when two directed numbers are multiplied, if both numbers have the same sign, the sign of the product is positive
- That if just one of the two numbers to be multiplied is negative, then the product is negative
- That when one directed number is divided by another, if the two numbers have the same sign, then the quotient is positive
- That in a division of a directed number by another, if just one of the numbers is negative, the quotient is negative

(30 minutes)

Criteria for Assessment and Evaluation:

- Manipulates directed numbers under the mathematical operation subtraction.
- Manipulates directed numbers under the mathematical operations multiplication and division.
- Simplifies expressions of directed numbers that include all the basic mathematical operations.
- Uses patterns to simplify complex cases.
- Facilitates tasks by converting complex cases into simpler ones.

Annex 1.2.1

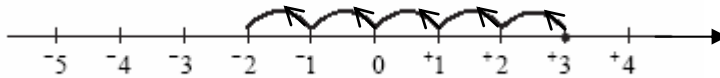
Instructions for group exploration

Let us manipulate directed numbers under the mathematical operations

Part I

Let us subtract directed numbers

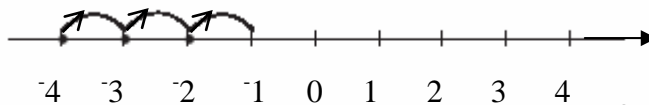
The method of determining $-2 - (+3)$ using a number line is given below.



When moving from $+3$ to -2 , you move 5 units to the left; that is 5 units in the negative direction. Therefore the answer is -5 .

$$(-2) - (+3) = -5$$

Let us find $(-1) - (-4)$ in the same manner.



Since you travel 3 units in the positive direction, $(-1) - (-4) = +3$. Study this carefully.

- Focus your attention on the case that your group received from the cases A, B, C given below.

| | | |
|---|------------------------------------|---|
| A | (i) $5 - 3$ $8 - 8$ | (ii) $5 + (\dots) = \dots$ $8 + (\dots) = \dots$ |
| B | (i) $(-3) - (-8)$ $(-5) - (-4)$ | (ii) $(-3) + (\dots) = \dots$ $(-5) + (\dots) = \dots$ |
| C | (i) $(5) - (-3)$ $(4) - (-4)$ | (ii) $(5) + (\dots) = \dots$ $(4) + (\dots) = \dots$ |

- Describe the case (i) that you obtained in words, and find the solution by simplifying the problem as shown in the chart above.
- Fill in the blanks in case (ii) in a manner such that you obtain the same solution as in case (i).
- What is the relationship between the number you subtracted in case (i) and, to get the same answer, the number you added instead of it in case (ii)?
- Let the group put forward their ideas about the changes that occur to the number that is subtracted.
- Select a positive and negative number between -5 and 5 and write them down as a subtraction of one from the other.
- Determine the solution of the subtraction using the method you discovered above.
- Interchange the two numbers and obtain the solution to this problem.
- Present another method to subtract directed numbers easily.
- Prepare to present your findings creatively at the plenary session.

Part II

Let us multiply directed numbers; let us divide them

Chart 1

| A | | B |
|-----|------------------------|---|
| 4 | $\times 2 \rightarrow$ | 8 |
| 3 | $\times 2 \rightarrow$ | 6 |
| 2 | $\times 2 \rightarrow$ | 4 |
| ... | $\times 2 \rightarrow$ | |
| ... | $\times 2 \rightarrow$ | |
| ... | $\times 2 \rightarrow$ | |
| ... | $\times 2 \rightarrow$ | |
| ... | $\times 2 \rightarrow$ | |

Chart 2

| A | | B |
|---------------|-------------------|----|
| $(-2) \times$ | 3 \rightarrow | -6 |
| $(-2) \times$ | 2 \rightarrow | -4 |
| $(-2) \times$ | 1 \rightarrow | -2 |
| $(-2) \times$ | 0 \rightarrow | 0 |
| $(-2) \times$ | ... \rightarrow | |
| $(-2) \times$ | ... \rightarrow | |
| $(-2) \times$ | ... \rightarrow | |
| $(-2) \times$ | ... \rightarrow | |
| $(-2) \times$ | ... \rightarrow | |

Chart 3

| A | | B |
|--------------|---------------|---|
| $16 \div 2$ | \rightarrow | 8 |
| $12 \div 2$ | \rightarrow | 6 |
| $8 \div 2$ | \rightarrow | 4 |
| $4 \div 2$ | \rightarrow | 2 |
| $0 \div 2$ | \rightarrow | 0 |
| ... $\div 2$ | \rightarrow | |
| ... $\div 2$ | \rightarrow | |
| ... $\div 2$ | \rightarrow | |
| ... $\div 2$ | \rightarrow | |

- Focus your attention on the chart received by your group from the charts given above and study the pattern in it carefully.
- By considering the pattern of the values written in column A and in column B, fill in the blanks.
- By studying the pattern of the values in the two filled in columns, determine the sign of the product/quotient of two positive numbers, the sign of the product/quotient of a negative number and a positive number, and the sign of the product/quotient of two negative numbers

- Consider the cases given below and fill in the blanks.

$$2 \times 3 = 6 \Rightarrow 6 \div 2 = 3$$

$$6 \div 3 = 2$$

$$(-2) \times 3 = (-6) \Rightarrow (-6) \div (-2) = 3$$

$$(-6) \div (-3) = \dots\dots$$

$$(-2) \times (-3) = 6 \Rightarrow 6 \div (-2) = (-3)$$

$$6 \div (-3) = \dots\dots$$

- Based on your findings determine the sign of the product/quotient of two negative numbers.
- Fill in the table accordingly.

| The sign of the numbers in each case | The sign of the solution |
|--------------------------------------|--------------------------|
| positive ÷ positive | |
| positive ÷ negative | |
| negative ÷ positive | |
| negative ÷ negative | |

- Discuss within the group how the sign of the solution is obtained when directed numbers are multiplied, divided.
- Prepare to present your findings creatively at the plenary session.

5. Algebraic Expressions

Competency 14 : Simplifies algebraic expressions by systematically exploring various methods.

Competency Level 14.1 : Simplifies algebraic expressions by removing brackets and finds the value by substitution.

Activity 14.1 : Let us simplify algebraic expressions.

Time : 55 minutes.

Quality Inputs :

- An enlarged copy of the chart of figures in Annex 14.1.1.
- Three copies of the instruction leaflet on exploration included in Annex 14.1.2.
- Demy papers and pastels.

Learning – Teaching Process:

Step 14.1.1 :

- Present the chart of figures related to algebraic expressions to the class and inquire from them about constructing algebraic expressions, simplifying them and substituting values into them.

- Lead a discussion and highlight the following facts.

- That expressions with an unknown term are algebraic expressions
- That the number by which an unknown in an algebraic term is multiplied is the coefficient of the unknown
- That when multiplying an algebraic term by a number, the relevant coefficient is multiplied by the number
- That when an algebraic expression is being simplified, like terms are added together or subtracted
- That the value of an algebraic expression can be obtained by substituting a number for the unknown and then simplifying the expression

(10 minutes)

Step 14.1.2 :

- Divide the class into three small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.

- Engage the small groups in exploration.
- Let them prepare for presentations at the plenary session. (25 minutes)

Step 14.1.3

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That brackets are used to indicate multiplication of an algebraic expression by a number
- That when simplifying an algebraic expression with brackets, all the terms within a bracket should be multiplied by the number outside the bracket
- That the value of an algebraic expression can be obtained by substituting values for the unknowns and then simplifying the expression

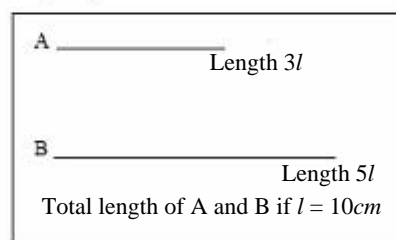
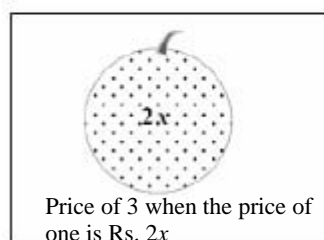
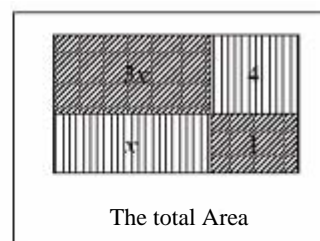
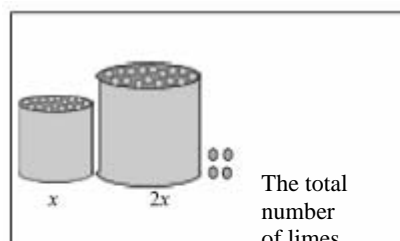
(20 minutes)

Criteria for Assessment and Evaluation:

- Constructs an algebraic expression based on given information.
- Simplifies an algebraic expression with brackets.
- Provides reasons for the fact that the value obtained for an algebraic expression with brackets by removing the brackets, simplifying the expression and then substituting the values for the unknowns is the same as the value obtained by first substituting the values for the unknowns and then simplifying the expression.
- Finds out about the various methods of solving problems in daily life.
- Compares the results from various applications.

Annex 14.1.1

Chart of Figures



Annex 14.1.2

Instructions for group exploration

Let us simplify algebraic expressions

| | Types of items in a Set, with the Amounts | | Number of Sets |
|----------|--|---|-------------------|
| A | Pencil Boxes | 1 | 4 |
| | 200 page books | 3 | |
| | Pens | 2 | |
| | Pencils | 1 | |
| B | 200 page books | 2 | 5 |
| | 80 page books | 2 | |
| | Pens | 3 | |
| | Pencils | 1 | |
| C | 200 page books | 1 | 7 |
| | 80 page books | 4 | |
| | Pens | 2 | |
| | Pencils | 1 | |

Price List

| Item | Price of an Item (Rs.) |
|---------------|------------------------------|
| 200 page book | $4y$ |
| 80 page book | x |
| Pencil Box | $3x$ |
| Pen | y |
| Pencil | 8 |

- Focus your attention on the set of items received by your group from the sets given above.
- Construct an algebraic expression for the value of one set of items based on the given price list, and simplify it as much as possible.
- Using the above constructed algebraic expression, obtain an algebraic expression containing brackets for the value of all the sets of items received by your group.
- By determining the total number of each type of item in your collection of sets, construct an algebraic expression for the total value of the items and simplify it as much as possible.
- What can be said about the two expressions you obtained for the total value?
- Propose a method that could be used to obtain the expression constructed second from the expression with brackets, and obtain it.
- Using the constructed expressions, determine the price of
 - one set of items
 - all the sets of items
when $x = 8$ and $y = 15$
- Prepare for a presentation of your findings at the plenary session.

6. Solids

Competency 22 : Creates new models by exploring various solids.

Competency Level 22.1 : Creates solids and confirms the relationships between properties.

Activity 22.1 : Let us create new solids.

Time : 85 minutes.

Quality Inputs :

- A cube with sides of length 10 cm each and a regular tetrahedron with sides of length 10 cm each.
- A cuboid with dimensions 10 cm × 6 cm × 5 cm.
- A pyramid with square base of dimensions 10 cm × 10 cm.
- Two icosahedrons.
- Two copies of the instruction leaflet on exploration included in Annex 22.1.1.
- Bristol boards.
- Pairs of scissors and gum.

Learning – Teaching Process:

Step 22.1.1 :

- Present the four prepared solids to the class and conduct a ‘minute only’ programme during which four selected students speak about the four solids.
- Based on the programme, lead a discussion and highlight the following facts.

- That the edges of a cube and a regular tetrahedron are straight edges of equal length
- That the faces of a cube and a regular tetrahedron are regular polygons
- That in a cube and a regular tetrahedron, the number of edges extending from each vertex is equal
- That the above features are not present in a cuboid or a pyramid with a square base
- That Euler’s Relationship is given by ‘number of faces + number of vertices = number of edges + 2’
- That Euler’s Relationship holds for all four of the above mentioned solids
- That solids can be named based on the number of faces it contains. e.g.: tetrahedron

(15 minutes)

Step 22.1.2

- : • Divide the class into two small groups.
- Distribute the instructions on exploration, icosahedrons, gum, pairs of scissors and Bristol boards among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the small groups prepare for presentations at the plenary session.

(40 minutes)

Step 22.1.3

- : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That the new model created by joining the square faces of two pyramids with equal square bases is an octahedron
- That a regular octahedron consists of 8 regular faces
- That an equal number of edges extend from each vertex of an octahedron
- That the new model created from pentagons is a dodecahedron
- That a regular dodecahedron has 12 regular faces
- That an equal number of edges extend from each vertex of a dodecahedron too
- That Euler's relationship holds for octahedrons, dodecahedrons and icosahedrons too

(30 minutes)

Criteria for Assessment and Evaluation:

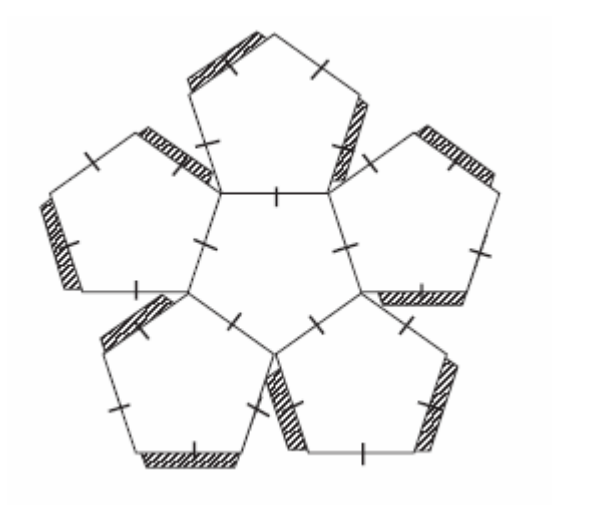
- Describes the features of octahedrons and dodecahedrons.
- Shows that Euler's relationship holds for octahedrons, dodecahedrons and icosahedrons.
- Shows that Euler's relationship holds for any solid with plane faces.
- Tends to compare things having various connections.
- Develops the habit of working according to a plan.

Annex 22.1.1

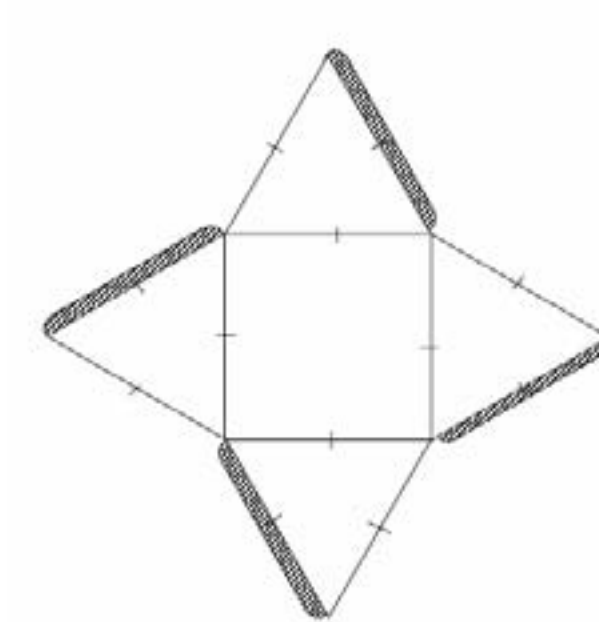
Instructions for group exploration

Let us create new solids

- Net I



- Net II



- From the above given nets, draw the net assigned to your group twice on a piece of Bristol board.
- Cut out the two nets with the allowances for pasting.
- Create two new models by pasting along the allowances.
- Create a solid with regular faces by joining the two models together.
- Investigate the shapes of the faces and the edges and write a report.
- Propose a suitable name for the solid by considering the number of faces of the solid.
- Compare this solid with other solids that you know.
- Examine whether the icosahedron that you received and the solid that you created satisfy Euler's relationship.
- Prepare for a presentation of your findings at the plenary session.

7. Factors

Competency 15 : Factorizes algebraic expressions by systematically exploring various methods.

Competency Level 15.1 : Factorizes algebraic expressions.

Activity 15.1 : Let us find the factors of algebraic expressions.

Time : 65 minutes.

Quality Inputs :

- An enlarged copy of the chart included in Annex 15.1.1
- Three copies of the instruction leaflet on exploration included in Annex 15.1.2.
- Demy papers and pastels.

Learning – Teaching Process:

Step 15.1.1 :

- Display the enlarged copy of the chart in front of the class and while filling in the blanks, inquire from the students about factors, common factors, greatest common factor, algebraic terms and removing brackets from an algebraic expression.
- Lead a discussion and highlight the following facts

- That determining the greatest common divisor of several algebraic terms is facilitated by writing the coefficient of each algebraic term as a product of its prime factors
- That the greatest common divisor of several algebraic terms can be found by writing the terms as products of their factors
- That when removing brackets from an algebraic expression, each term within the bracket has to be multiplied by the term outside the bracket

(20 minutes)

Step 15.1.2 :

- Divide the class into three small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the small groups prepare for a presentation at the plenary session.

(25 minutes)

Step 15.1.3

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That when factoring out common factors from an algebraic expression, the greatest common factor of the terms of the expression should be obtained
- That the greatest common factor of several algebraic terms could be an unknown or a number or a product of an unknown and a number.
- That an algebraic expression can be written as a product of factors by writing the greatest common divisor of the terms of the expression on the left hand side outside the bracket and the terms divided by the greatest common factor within the brackets
- That when an algebraic expression has been factored and written with brackets, by multiplying the terms within the bracket by the term outside the bracket the original expression is obtained

(20 minutes)

Criteria for Assessment and Evaluation:

- Writes a given algebraic term as a product of prime factors and algebraic factors.
- When factoring an algebraic expression, determines the greatest common divisor of the terms of the expression.
- Factorizes an algebraic expression.
- In daily tasks, is inclined towards finding out about things that are common.
- Gains satisfaction by examining the accuracy of things.

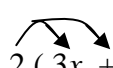
Annex 15.1.1

Chart

1. $3 \times x = 3x$
 $3 \times x \times y = \dots\dots\dots$

2. $12 = 2 \times \dots \times \dots$
 $12ab = \dots \times \dots \times \dots \times \dots \times \dots$
 $3x^2y = \dots \times \dots \times \dots \times \dots$

3. $3xy = 3 \times x \times y$
 $6x^2 = 2 \times 3 \times x \times x$
 $9xy^2 = \dots \times \dots \times \dots \times \dots \times \dots$
 \therefore greatest common factor of $3xy, 6x^2, 9xy^2 = \dots \times \dots = \dots\dots\dots$

4.  $2(3x + 5) = \dots\dots + \dots\dots$

Annex 15.1.2

Instructions for group exploration**Let us find the factors of algebraic expressions**

| | |
|---|-------------------|
| 1 | $6xy + 12x - 9y$ |
| 2 | $5a^2 + 3ab - 2a$ |
| 3 | $4mn + 6m^2 - 8m$ |

- Focus your attention on the algebraic expression received by your group from the algebraic expressions given above.
- Taking the three terms of the expression separately, write each one as product of prime factors and algebraic factors.
- Determine the greatest common factor of the three terms by considering the products of factors written above, enter it in the \square below and suitably fill in the given blanks with the terms obtained by dividing each term in the given expression by the greatest common factor.

$$\square (\dots + \dots + \dots)$$

- Examine whether the original expression is obtained when the brackets are removed from the above completed expression.
- Discuss the relationship between the expression received by the group and the expression written down with brackets.
- Factor the expressions obtained by the other groups too and then examine the accuracy of the factorization by removing the brackets.
- Present facts about the importance of determining the greatest common factor of the terms of an expression when factoring out common terms from the expression
- Prepare for a presentation of the group's findings at the plenary session.

8. Square root

Competency 01 : Manipulates the mathematical operations in the set of real numbers to fulfill the needs of day to day life.

Competency Level 1.1 : Inquires into the relationships between whole numbers.

Activity 1.1 : Let us find the square root of numbers.

Time : 130 minutes.

Quality Inputs :

- The chart included in Annex 1.1.1.
- Four copies of the instruction leaflet on exploration included in Annex 1.1.2.
- Demy papers and pastels.

Learning – Teaching Process:

Step 1.1.1 :

- Display the poster with
 - i. numbers that are of power two
 - ii. compound numbers as products of their prime factors.
- Lead a discussion and highlight the following facts.

- That numbers that can be represented as the 2nd power of a number are **square numbers**
- That by multiplying a number by itself a square number is obtained
- That compound numbers/square numbers can be written as products of prime factors

Step 1.1.2 :

- Divide the class into four small groups. (20 minutes)
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on part I of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the small groups prepare for presentations at the plenary session. (30 minutes)

Step 1.1.3 :

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That when the end digit of a square number is 0, the end digit of its square root should also be 0
- That when the end digit of a square number is 5, the end digit of its square root should also be 5
- That when the end digit of a square number is 4, the end digit of its square root should be either 2 or 8
- That when the end digit of a square number is 6, the end digit of its square root should be either 4 or 6
- That when the end digit of a square number is 1, the end digit of its square root should be either 1 or 9
- That when the end digit of a square number is 9, the end digit of its square root should be either 3 or 7
- That 2, 3, 7, 8 do not appear as the end digit of a square number
- That to guess the square root of some square numbers it is required to consider the last two digits of the square number
- That a decision can be made on the accuracy of a number assumed to be the square root of a square number by dividing the square number by the number assumed to be the square root
- That the symbol ' $\sqrt{\quad}$ ' is used to write the square root of a number

(30 minutes)

Step 1.1.4

- Organize the groups again.
- Focus the attention of the groups on part II of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for presentations at the plenary session.

(20 minutes)

Step 1.1.5

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That square numbers can be written as products of prime factors
- That square numbers can be written as the product of two equal groups of factors
- That one set from the two equal groups is the square root of the square number

(30 minutes)

Criteria for Assessment and Evaluation:

- Writes the square root of a perfect square number which is less than 100.
- Guesses the square root of a number based on its position and upon observation of its end digits.
- Determines the square root of square numbers by considering their prime factors.
- Identifies relationships by studying information.
- Makes correct decisions based on the identified relationships.

Annex 1.1.1

$$\begin{aligned}
 2^2 &= 2 \times 2 \rightarrow 4 \\
 3^2 &= 3 \times 3 \rightarrow 9 \\
 4^2 &= 4 \times 4 \rightarrow 16 \\
 6^2 &= 6 \times 6 \rightarrow 36
 \end{aligned}$$

Square numbers 1, 4, 9, 16, 25, 36,

Compound numbers as the product of prime factors

$$\begin{array}{r}
 2 \overline{)24} \\
 2 \overline{)12} \\
 2 \overline{)6} \\
 3
 \end{array}$$

$$\begin{array}{r}
 2 \overline{)36} \\
 2 \overline{)18} \\
 3 \overline{)9} \\
 3
 \end{array}$$

$$24 = 2 \times 2 \times 2 \times 3$$

$$36 = 2 \times 2 \times 3 \times 3$$

Annex 1.1.2

Instructions for group exploration

Let us find the square root of numbers

As 9 is obtained by squaring the number 3, the square root of 9 is defined as 3. Accordingly the square root of 16 is obtained as 4.

$$3^2 = 9 \rightarrow \text{the square root of 9 is 3} \rightarrow \sqrt{9} = 3$$

$$4^2 = 16 \rightarrow \text{the square root of 16 is 4} \rightarrow \sqrt{16} = 4$$

$$5^2 = 25 \rightarrow \text{the square root of 25 is 5} \rightarrow \sqrt{25} = 5$$

$$6^2 = 36 \rightarrow \text{the square root of 36 is 6} \rightarrow \sqrt{36} = 6$$

Part I

- Multiply the numbers from 1 to 15 by the numbers themselves and using the square numbers you thereby obtain complete the following table.

| | | | | | | | | | | | | | | |
|---------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Square Number | | | | | | | | | | | | | | |
| Square root | | | | | | | | | | | | | | |

- Engage in an investigation of the end digit of the square numbers and the end digit of the corresponding square root. Note down the identified information.

| | |
|--|---------------------------------------|
| Pair of Numbers i 289, 324 | Pair of Numbers ii 361, 529 |
| Pair of Numbers iii 676, 729 | Pair of Numbers iv 784, 841 |

- Focus your attention on the pair of numbers received by your group from the pairs of numbers given above. Based on the experience and knowledge you gained above, guess the square root of the numbers you received.
- Suggest a method that could be used to determine whether your judgements are correct.
- Prepare for a presentation at the plenary sessions.

Part II

- Focus your attention on the number relevant to your group from the following numbers.

| | | | |
|------|------|-----|------|
| 2025 | 4900 | 784 | 1764 |
|------|------|-----|------|

- Write the number as a product of prime factors.
- Divide the product of prime factors into two equal groups and write it down

In the form $*** = (5 \times 3) \times (5 \times 3)$

- Based on it, determine the square root of the number.
- Prepare for a presentation at the plenary session.

9. Mass

Competency 9 : Fulfills daily requirements by working with an awareness of mass.

Competency Level 9.1 : Facilitates daily work by investigating large masses.

Activity 9.1 : Let us write large masses in a convenient form.

Time : 75 minutes.

Quality Inputs :

- Four copies of the instruction leaflet on exploration included in Annex 9.1.1.
- Large attractive pictures of a vehicle, a man and a tablet.
- Demy papers.
- Marker pens/pastels.

Learning – Teaching Process:

Step 9.1.1 :

- Present the figures to the class and inquire from the students about the relationship between the mass of the vehicle, man, tablet, and the units kg , g , mg .
- Lead a discussion and highlight the following facts.

- That in daily life it is required to measure small masses, normal masses and large masses
- That the unit mg is used to measure small masses and the unit kg is used to measure normal masses
- That a measure greater than kg is required to measure large masses
- That $1 g = 1000 mg$
- That $1 kg = 1000 g$

(15 minutes)

Step 9.1.2 :

- Divide the class into four small groups.
- Distribute the instructions on exploration, demy papers and marker pens/pastels among the groups.
- Focus the attention of the groups on the instructions on exploration, assign the relevant task to each group, and engage the small groups in exploration.
- Let the groups prepare for presentations at the plenary session.

(30 minutes)

Step 9.1.3 :

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.

- Seek for constructive comments from the other groups.
- Engage in a review and highlight the following facts.

- That when performing calculations involving large masses, to convert a quantity in metric tons into a quantity in kilograms, the quantity in metric tons has to be multiplied by 1000
- That to convert a quantity in kilograms into a quantity in metric tons, the quantity in kilograms has to be divided by 1000
- That there are instances when a quantity in kilograms has to be converted into a quantity in tons in multiplications involving tons and kilograms
- That there are instances when a quantity in tons has to be converted into a quantity in kilograms in divisions involving tons and kilograms
- That it is more convenient to represent large masses in metric tons

(30 minutes)

Criteria for Assessment and Evaluation:

- Converts a mass given in kilograms into a mass in tons.
- Adds, subtracts masses given in metric tons and kilograms.
- Solves problems involving metric tons and kilograms.
- Actively aids in the activity by making critical inquiries regarding the activities of the other groups.
- Uses measures logically to solve problems in daily life.

Annex 9.1.1

Instructions for group exploration

Let us write large masses in a convenient form

| Item | Mass |
|---------------|---------|
| Bus | 7600 kg |
| Van | 4700 kg |
| Motor cycle | 200 kg |
| Boat | 3600 kg |
| Tractor | 3800 kg |
| Man | 60 kg |
| Bag of Cement | 50 kg |

Table 1

| Group | Item | |
|-------|-----------------------------------|------------------------------|
| A | 1. Bus 3. Van | 2. Tractor 4. 3 Men |
| B | 1. Tractor 3. 5 Bags of Cement | 2. 5 Motor cycles 4. Boat |
| C | 1. Bus 3. 7 Men | 2. Tractor 4. Motor cycle |
| D | 1. Van 3. Boat | 2. Tractor 4. 8 men |

- Focus your attention on the items assigned to your group.
- Determine the total sum of the masses of all the items assigned to your group.
- You will notice that the total mass is numerically a large value.
Use the following relationship to convert the mass into metric tons and thereby make the numerical value small.

| | | |
|----------------|---|--------------|
| 1000 kilograms | = | 1 metric ton |
| 1000 <i>kg</i> | = | 1 <i>t</i> |

- Write down the masses of each of the items you received in terms of metric tons and kilograms. (e.g. 3450 *kg* = 3 *t* 450 *kg*).
- Determine the total mass of item 1 and item 3 using the values written in terms of tons and kilograms.
- Determine the difference in the masses of item 1 and item 2 using the values written in terms of tons and kilograms.
- Determine the mass of an item that has a mass which is four times the mass of a lorry of mass 7 *t* 400 *kg*.
- If the above mentioned lorry which is of mass 7 *t* 400 *kg* can carry a maximum mass of exactly half its mass, discuss the steps that need to be carried out to determine the maximum mass in terms of *t* and *kg*, that the lorry can carry.
- Prepare to present your findings creatively at the plenary session.

10. Indices - I

Competency 06 : Easily solves mathematical problems in day to day life by using logarithms and calculators.

Competency Level 6.1 : Simplifies powers of a product using expansion.

Activity 6.1 : Let us simplify powers of a product.

Time : 90 minutes.

Quality Inputs :

- Four copies of the instruction leaflet on exploration included in Annex 6.1.1.
- Demy papers and pastels.

Learning – Teaching Process:

Step 6.1.1 :

- Present several powers such as 2^2 , 2^3 , 3^3 to the class, and inquire from the students about determining their value by expanding them and writing.
- Lead a discussion so that the following facts are highlighted

- That finding the value of a power is made easier by expanding it and writing
- That other relationships can be found by expanding expressions with powers

(10 minutes)

Step 6.1.2 :

- Divide the class into four small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the small groups prepare for presentations at the plenary session.

(30 minutes)

Step 6.1.3 :

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That a power of a product can be written as a product of powers
- That a product of powers can be written as a power of a product
- That this process can be written as an algebraic expression in the form $(ab)^n = a^n \times b^n$

(50 minutes)

Criteria for Assessment and Evaluation:

- Expands and writes a power.
- Writes powers that have been expanded and written as powers in other forms.
- Writes powers of products as products of powers and products of powers as powers of products.
- Confirms the accuracy of results by calculations.
- Approaches success by following the right steps.

Annex 6.1.1**Instructions for group exploration****Let us simplify powers of a product**

- Focus your attention on the expressions received by your group from the following expressions.

Expressions

| | |
|-------------------|-------------------|
| $*(3 \times 2)^2$ | $*(4 \times 3)^2$ |
| $*(4 \times 5)^3$ | $*(2 \times 5)^3$ |
| $*(3 \times 2)^3$ | $*(4 \times 3)^3$ |
| $*(4 \times 5)^2$ | $*(2 \times 5)^2$ |

- Expand and write the first expression received by your group as a product of the numbers within the brackets.
- Separate the numbers in the expansion and write them within two brackets such that each bracket contains only one type of number.
- Obtain an expression which is a product of two powers and is equal to the initial expression of a power of a product of two numbers, by writing the number within each bracket as a power of a number.
- In the same manner, convert the second expression you received also into a product of powers by first expanding it.
- Considering the above relationship, obtain an expression which is a product of two powers and equivalent to $(a \times b)^n$.
- Based on it, obtain an expression which is a single power of an expression and equivalent to $x^n \times y^n$.
- Prepare to present your findings creatively at the plenary session.

10. Indices - II

Competency 06 : Easily solves mathematical problems in day to day life by using logarithms and calculators.

Competency Level 6.2 : Expands a power of a negative integer and finds the value.

Activity 6.2 : Let us determine powers of a negative integer.

Time : 75 minutes.

Quality Inputs : • Two copies of the instruction leaflet on exploration included in Annex 6.2.1.
• Demy papers and pastels.

Learning – Teaching Process:

Step 6.2.1 : • Inquire from the students about expanding and finding the value of powers of the form 2^3 , 3^4 and about multiplying directed numbers.

• Lead a discussion and highlight the following facts.

- That a power can be written as a repeated product
- That the value of a power can be found by repeated multiplication
- That when multiplying two directed numbers, if the signs of the two numbers are identical, then the sign of the product is positive
- That when multiplying two directed numbers, if the sign of one number is positive and the sign of the other is negative, the sign of the product is negative

Step 6.2.2 : • Divide the class into two small groups. (15 minutes)

- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for presentations at the plenary session. (30 minutes)

Step 6.2.3 : • Provide each small group with the opportunity to present the findings of the group.

- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That the value of a power of a negative integer can be obtained by writing the power as a repeated product
- That when the index of a power of a negative integer is an even number, the value that is obtained for the power is positive
- That when the index of a power of a negative integer is an odd number, the value that is obtained for the power is negative

(30 minutes)

Criteria for Assessment and Evaluation:

- Expands a power with a negative integer as its base.
- Decides whether the sign of the value of a power of a negative integer is positive or negative by observing the index.
- Determines the value of a power with a negative integer as its base.
- Comes to right conclusions with experience.
- Attains success by working in a disciplined manner.

Annex 6.2.1**Instructions for group exploration****Let us determine powers of a negative integer**

- Focus your attention on the section received by your group from the following sections.

| Section 1 | Section II |
|-----------|------------|
| $(-2)^3$ | $(-3)^2$ |
| $(-3)^1$ | $(-2)^4$ |

- Expand and write the powers received by your group.
- Find the value of the powers by multiplying the terms obtained in the expansion.
- Write down any negative integer and obtain the value of various powers of the number by expanding the power and multiplying the terms.
- What can be said about the sign of the value of a power of a negative integer when the index is odd/even?
- Based on this, what can you conclude about the sign of the value of a power of a negative integer, when the index of the power is odd/even?
- Prepare for a presentation at the plenary session.

11. Symmetry

Competency 25 : Observes the beauty of the environment by exploring the properties of various shapes.

Competency Level 25.1 : Inquires into the results of a rotation that are based on symmetry.

Activity 25.1 : Let us overlap shapes by rotation.

Time : 60 minutes.

Quality Inputs :

- Several symmetrical and non-symmetrical shapes found in the environment.
- The fortune wheel found in Annex 25.1.1 colourfully made with two fairly large cardboard circles and ordered in degrees.
- Four copies of the instruction leaflet on exploration included in Annex 25.1.2.
- Clips and tissue papers.
- Demy papers and pastels.

Learning – Teaching Process:

Step 25.1.1

- Present the symmetrical and non-symmetrical shapes to the class and initiate a discussion on symmetrical shapes and the axis of symmetry.
- Indicate clockwise and anticlockwise rotation using the fortune wheel in the figure and lead a discussion and highlight the following facts.

- That a line by which a symmetrical figure can be divided into two equal parts is an axis of symmetry
- That a symmetrical figure can have more than one axis of symmetry
- That clockwise rotation is rotation in the direction the hands on a clock moves and anticlockwise rotation is rotation in the opposite direction
- That the amount of rotation can be indicated by the size of an angle

(15 minutes)

Step 25.1.2

- Divide the class into four small groups.
- Distribute the instructions on exploration, demy papers, pastels, tissue papers and clips among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let them prepare for a presentation at the plenary session.

(30 minutes)

Step 25.1.3

- : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That a plane figure has rotational symmetry if it overlaps more than once with itself when it is rotated by 360° about its centre of symmetry
- That the order of rotational symmetry of a figure that has rotational symmetry is the number of times the figure overlaps with itself when it is rotated one full round from its initial position about its centre of symmetry
- That the number of axes of symmetry and the order of rotational symmetry is equal for a figure with bilateral symmetry
- That the centre of symmetry of a plane figure with more than one bilateral axis of symmetry is the intersection point of the axes of symmetry

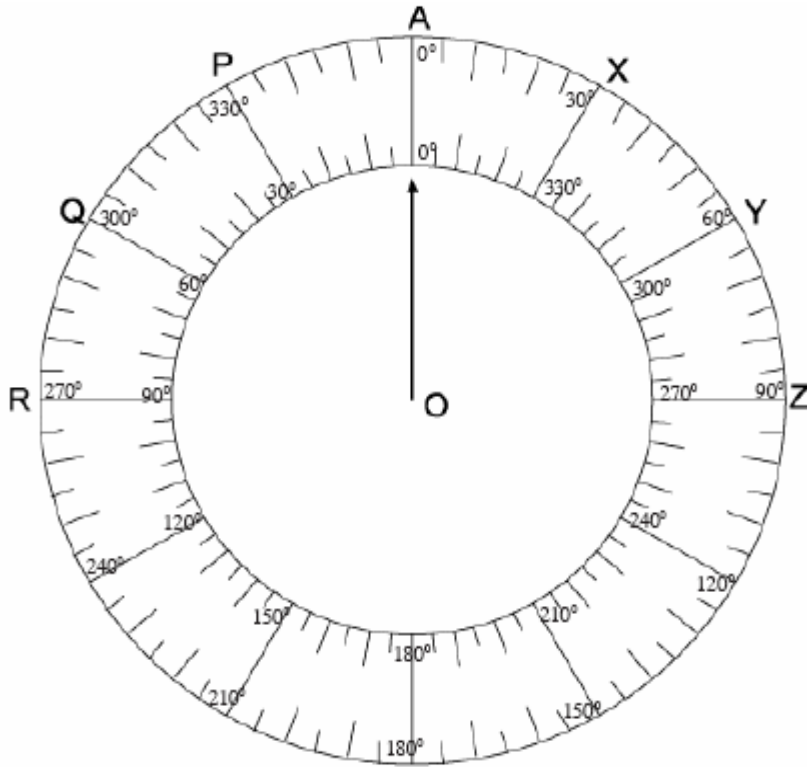
(15 minutes)

Criteria for Assessment and Evaluation:

- Identifies plane figures which have rotational symmetry.
- Determines a numerical relationship between the order of rotational symmetry and the number of axes of symmetry in a plane figure with bilateral symmetry.
- Determines the centre of symmetry and the order of rotational symmetry of a plane figure which has rotational symmetry.
- Engages in creations by applying symmetry to the shapes in the environment.
- Works with team spirit.

Annex 25.1.1

Chart

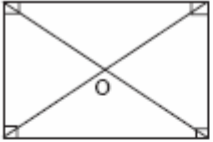
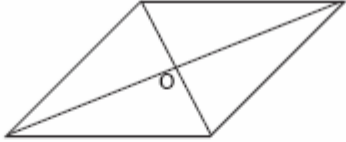
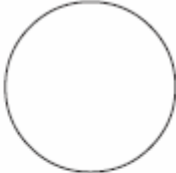
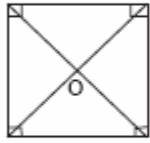
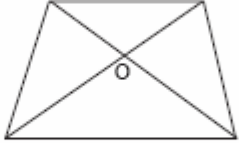
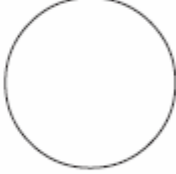
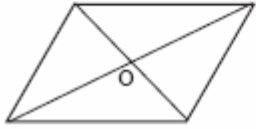
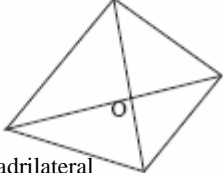
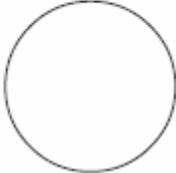
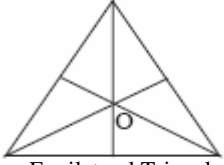
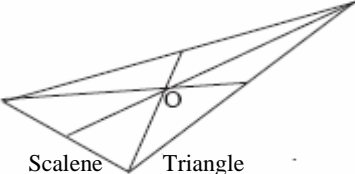
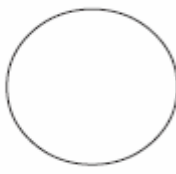


Clockwise and anticlockwise rotation and the amount of rotation can be demonstrated using the indicator fixed at the point O.

Annex 25.1.2

Instructions for group exploration

Let us overlap shapes by rotation

| Group | | | |
|-------|---|--|---|
| 1 |  <p data-bbox="443 752 544 775">Rectangle</p> |  <p data-bbox="671 752 799 775">Parallelogram</p> |  |
| 2 |  <p data-bbox="443 927 512 949">Square</p> |  <p data-bbox="719 927 831 949">Trapezium</p> |  |
| 3 |  <p data-bbox="443 1126 587 1149">Parallelogram</p> |  <p data-bbox="715 1126 842 1149">Quadrilateral</p> |  |
| 4 |  <p data-bbox="427 1317 624 1339">Equilateral Triangle</p> |  <p data-bbox="683 1317 900 1339">Scalene Triangle</p> |  |

- Focus your attention on the shapes received by your group.
- Determine the number of axes of symmetry in the plane figures.
- Draw the figures on a tissue paper.
- Using a pin, fix the figure drawn on the tissue paper at the point O of the relevant figure and rotate the figure on the tissue paper.
- Determine the number of times the figures overlap when the figure on the tissue paper is rotated one whole round.
- What is the relationship between the number of axes of symmetry of the figure and the number of times the two figures overlapped?
- Find the point around which the circle should be rotated to determine its order of rotational symmetry.
- How many times do the two circles overlap when the one on top is rotated one full round?
- Suggest a name for the point around which the figures were rotated.
- Propose methods that can be used to find this point.
- Prepare to present your findings creatively at the plenary session.

12. Triangles

- Competency 23** : Makes decisions regarding day to day activities based on geometrical concepts related to rectilinear plane figures.
- Competency Level 23.1** : Inquires into the relationships between the various angles of rectilinear plane figures.
- Activity 23.1** : Let us determine the sum of the interior angles and the sum of the exterior angles of triangles and quadrilaterals.
- Time** : 155 minutes.
- Quality Inputs** :
- The figure included in Annex 23.1.1.
 - Four copies of the instruction leaflet on exploration included in Annex 23.1.2.
 - The following shapes cut out from thick cardboard (Bristol Board).
 - A right-angled triangle.
 - An obtuse angled triangle.
 - An equilateral triangle.
 - A scalene triangle.
 - A rectangle.
 - A square.
 - A parallelogram.
 - A quadrilateral with sides of different lengths.
 - Four pieces of thick cardboard (Bristol board) of dimensions $25\text{ cm} \times 15\text{ cm}$.
 - Pairs of scissors and gum.
 - Demy papers and pastels.

Learning – Teaching Process:

- Step 23.1.1** :
- Present the figure to the class and lead a discussion on the closed figures in it and their angles and sides.
 - During the discussion highlight the following facts.

- That closed figures made up of straight line segments are closed rectilinear plane figures
- That a figure can be named based on the number of straight line segments in it
- That closed rectilinear plane figures consisting of three sides are triangles
- That closed rectilinear plane figures consisting of four sides are quadrilaterals

- That the vertex angles within a plane figure are its interior angles
- That the exterior angles of a plane figure are the angles that are formed between a side of the figure and a produced side when the sides of the figure are produced clockwise or anticlockwise
- That the sum of the angles on a straight line equals 180°
- That the sum of the angles around a point equals 360°

(15 minutes)

Step 23.1.2

- : • Divide the class into four small groups.
- Distribute the instructions on exploration, shapes, Bristol boards, pairs of scissors, gum, demy papers and pastels among the groups.
- Focus the attention of the groups on Part I of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for presentations at the plenary session.

(40 minutes)

Step 23.1.3

- : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That the sum of the interior angles of a triangle equals 180°
- That two triangles are formed when one vertex of a quadrilateral is joined to the opposite vertex
- That the interior angles of the quadrilateral are obtained from the interior angles of the two triangles
- That the sum of the interior angles of a quadrilateral equals 360°

(30 minutes)

Step 23.1.4

- : • Organize the groups again.
- Focus the attention of the groups on part II of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for presentations at the plenary sessions.

(40 minutes)

Step 23.1.5

- : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

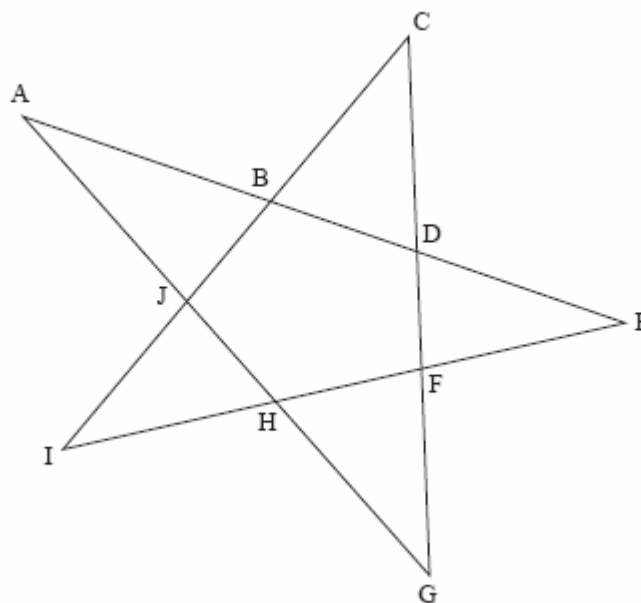
- That the number of exterior angles and the number of interior angles of a triangle are equal
- That the number of exterior angles and the number of interior angles of a quadrilateral are equal
- That the sum of the exterior angles of a triangle and the sum of the exterior angles of a quadrilateral are both equal to 360°

(30 minutes)

Criteria for Assessment and Evaluation:

- Determines the sum of the interior angles of a triangle.
- Determines the sum of the interior angles of a quadrilateral by means of the interior angles of a triangle.
- Engages in various analyses that are based on the interior and exterior angles of a triangle and a quadrilateral.
- Examines the truth/falsehood of information using various methods.
- Confirms facts while engaging in activities.

Annex 23.1.1



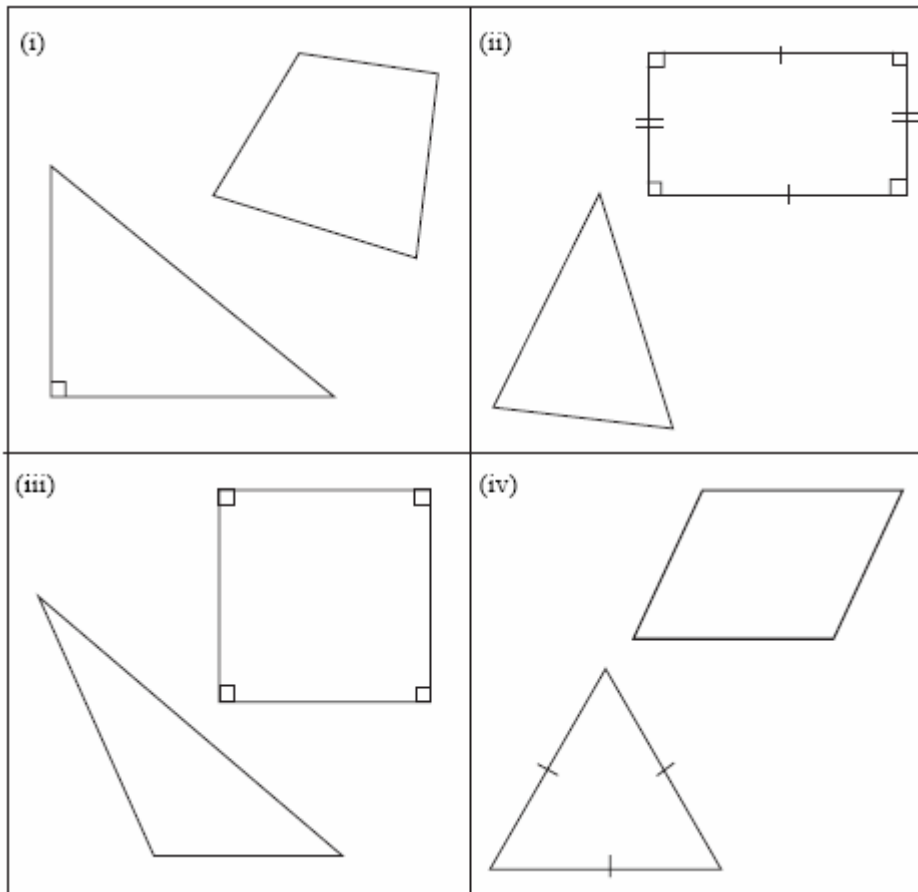
Annex 23.1.2

Instructions for group exploration

Let us determine the sum of the interior angles and the sum of the exterior angles of triangles and quadrilaterals

Part I

- Focus your attention on the interior angles of the pair of shapes assigned to your group from the pairs of shapes given below.



- Draw the triangle on another piece of paper and cut it out. Cut out its vertex angles and paste them on the thick cardboard in a manner such that the vertices are together and the angles are joined together but do not overlap with each other.
- Obtain a value for the sum of the interior angles of the triangle.
- Join a vertex of the quadrilateral to the opposite vertex, separate out the two triangles that are formed and by considering the interior angles of the triangles obtain a value for the sum of the interior angles of the quadrilateral.
- Using other methods also, examine the accuracy of the value you obtained for the sum of the interior angles.

- By applying what you have discovered, determine the value of the third interior angle of a triangle in which two of the interior angles are 60° and 40° and the fourth interior angle of a quadrilateral in which three of the interior angles are 70° , 90° and 100° .
- Prepare to present your findings at the plenary sessions.

Part II

- Focus your attention on the exterior angles of the pair of shapes you received in part I.
- Draw the shapes on another piece of paper and by producing all the sides of the two shapes in one direction, obtain their exterior angles.
- Measure the exterior angles of each of the shapes and find a value for the sum of the exterior angles of each shape.
- Examine the accuracy of your findings by using the value that you obtained for the sum of the interior angles.
- Examine whether the sum of the exterior angles of a triangle with interior angles of 60° , 40° and 80° and a quadrilateral with interior angles of 90° , 75° , 100° and 95° agree with your findings.
- Prepare to present your findings at the plenary sessions.

13. Fractions - I

Competency 03 : Manipulates units and parts of units under the mathematical operations to easily fulfill the requirements of day to day life.

Competency Level 3.1 : Manipulates units and parts of units under multiplication.

Activity 3.1 : Let us multiply fractions.

Time : 50 minutes.

Quality Inputs : • An enlarged copy of the Chart of Simplifications included in Annex 3.1.1.
• Three copies of the instruction leaflet on exploration included in Annex 3.1.2.
• Demy papers and pastels.

Learning – Teaching Process:

Step 3.1.1 : • Present the chart of various simplifications of fractions to the class and inquire from the students about the addition of fractions, conversion of mixed numbers and improper fractions, equivalent fractions, and the repeated addition of a number.
• Lead a discussion and highlight the following facts.

- That when adding fractions with equal denominators, only the numerators are added together
- That instead of adding a number repeatedly, the number can be multiplied by the number of times it is added
- That improper fractions can be written as mixed numbers and mixed numbers as improper fractions
- That by multiplying or dividing the numerator and the denominator of a fraction by the same number, an equivalent fraction can be written

(10 minutes)

Step 3.1.2 : • Divide the class into three small groups.
• Distribute the instructions on exploration, demy papers and pastels among the groups.
• Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
• Engage the small groups in exploration.
• Let the groups prepare for a presentation at the plenary session.

(20 minutes)

Step 3.1.3

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That when a fraction is multiplied by a whole number, only the numerator is multiplied by the whole number
- That in an instance such as $\frac{3}{10} \times 5$, since 5 is common to both the numerator and the denominator, the fraction should be simplified by dividing the numerator and the denominator by 5 as $\frac{3}{\cancel{10}_2} \times \frac{\cancel{5}_1}{1}$
- That now, since the numerator is 3×1 and the denominator is 2×1 , the solution is $\frac{3}{2}$
- That in a situation such as $\frac{3}{10} \times \frac{2}{9}$, since 3 and 2 are both common factors of the numerator and the denominator, the fraction should be simplified by dividing the numerator and the denominator by both 3 and 2 as $\frac{\cancel{3}^1}{\cancel{10}_5} \times \frac{\cancel{2}^1}{\cancel{9}_3}$
- That now, since the numerator is 1×1 and the denominator is 5×3 , the solution is $\frac{1}{15}$
- That when multiplying mixed numbers, they should first be converted into improper fractions

(20 minutes)

Criteria for Assessment and Evaluation:

- Multiplies a fraction by a whole number.
- Multiplies two fractions together.
- Multiplies two mixed numbers together and expresses the solution in the simplest form.
- Manipulates one's knowledge accurately to solve problems in daily life.
- Accepts the opinions and ideas of others by first examining them logically.

Annex 3.1.1

Chart of Simplifications

| | |
|--|--|
| $\frac{2}{7} + \frac{3}{7} + \frac{1}{7}$ $\frac{\square}{7}$ | $5 + 5 + 5 + 5 = \square$ $5 \times 4 = \square$ |
| $1\frac{2}{7} = \frac{\square}{7}$ $\frac{15}{8} = 1\frac{\square}{\square}$ | $\frac{6}{8} = \frac{\square}{4}$ $\frac{15}{12} = \frac{\square}{4} = 1\frac{\square}{\square}$ |

Annex 3.1.2

Instructions for group exploration

Let us multiply fractions

| A | B | C |
|--------------------------------------|---------------------------------------|--|
| (a) $\frac{2}{3} \times 5$ | (a) $\frac{3}{4} \times 3$ | (a) $\frac{2}{5} \times 4$ |
| (b) $\frac{3}{5} \times \frac{4}{9}$ | (b) $\frac{5}{6} \times 1\frac{2}{5}$ | (b) $2\frac{1}{2} \times 1\frac{4}{5}$ |

- Focus your attention on the section assigned to your group.
- Write the product in part (a) as a sum and obtain the solution.
- Propose a method to obtain the solution easily without using addition.
- When multiplying the fractions in part (b) using the above method, if there are common factors in the numerator and the denominator, first divide the numerator and the denominator by the common factor.
- Now multiply the numbers in the numerator separately and the numbers in the denominator separately and write down the fraction that you get as the answer.
- Describe the process that should be followed when multiplying fractions.
- Write down any two fractions that you like and determine their product.
- Prepare to explain to others the process that should be followed when multiplying fractions.

14. Fractions - II

Competency 03 : Manipulates units and parts of units under the mathematical operations to easily fulfill the requirements of day to day life.

Competency Level 3.2 : Manipulates units and parts of units under division.

Activity 3.2 : Let us find the reciprocal; let us divide fractions.

Time : 90 minutes.

Quality Inputs :

- An enlarged copy of the figure included in Annex 3.2.1
- Four copies of the instruction leaflet on exploration included in Annex 3.2.2.
- Demy papers and pastels.

Learning – Teaching Process:

Step 3.2.1 :

- Present the figure to the class and inquire from the students how the area of the figure was obtained.
- Discuss about the product of the fractions in it.
- During the discussion, highlight the following facts.

- That in an instance when a whole number is included in a product of fractions, the denominator of the whole number should be considered as 1
- That mixed numbers should be converted into improper fractions
- That when multiplying two fractions, if there are no common factors in the numerator and the denominator, the solution should be obtained by multiplying the numerator by the numerator and the denominator by the denominator
- That when multiplying two fractions, if there are common factors in the numerator and denominator, the solution should be obtained by simplifying them

(15 minutes)

Step 3.2.2 :

- Divide the class into four small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on Part I of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let them prepare for a presentation at the plenary session.

(20 minutes)

Step 3.2.3

- : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That if the product of two numbers is 1, then each number is the reciprocal of the other
- That the reciprocal of the non-zero whole number a is $\frac{1}{a}$
- That the reciprocal of a unit fraction of the form $\frac{1}{a}$ is a
- That the reciprocal of a fraction of the form $\frac{b}{a}$ is $\frac{a}{b}$
- That to obtain the reciprocal of a mixed number it has to be first converted into an improper fraction

(20 minutes)

Step 3.2.4

- : • Organize the groups again.
- Focus the attention of the groups on part II of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(20 minutes)

Step 3.2.5

- : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That the division of a fraction or a whole number by a fraction should be converted into a multiplication
- That when dividing a fraction by a fraction, the division should be converted into a product of the initial fraction and the reciprocal of the second fraction
- That after converting a division into a multiplication, the solution can be obtained easily

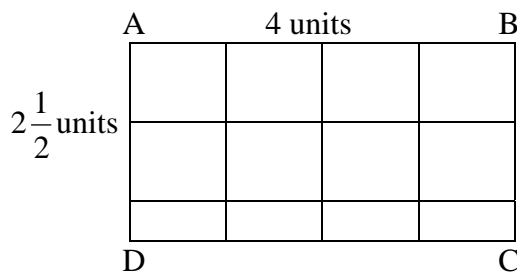
(15 minutes)

Criteria for Assessment and Evaluation:

- Divides a whole number by a fraction by taking the reciprocal of the fraction.
- Divides a fraction by another fraction.
- Simplifies mixed numbers under the mathematical operation division.
- Is inclined towards studying various relationships.
- Solves problems in daily life based on experience.

Annex 3.2.1

Figure



The area of the rectangle ABCD is 10 square units

Annex 3.2.2

Instructions for group exploration

Let us find the reciprocal; let us divide fractions

Part I

- Focus your attention on the number/fraction received by your group from the numbers/fractions given below.

| | | | |
|----------------|-----------------|-------------------|----------------------|
| I | II | III | IV |
| A whole number | A unit fraction | A proper fraction | An improper fraction |

- Write an appropriate value for the number/fraction received by you.
- Determine the whole number or fraction by which you should multiply the number you received to obtain a solution of 1.
- Investigate what relationship exists between the number or fraction you determined and the number you initially received.
- By studying the textbook, find a suitable name for the number/fraction you determined.
- Prepare to present your findings creatively at the plenary session.

Part II

- Focus your attention on the set of numbers received by your group from the following sets of numbers.

| | I | II | III | IV |
|---------------|-------------------|-----------------|----------------|----------------|
| First Number | 12 | $\frac{1}{8}$ | $\frac{1}{12}$ | $4\frac{1}{2}$ |
| Second Number | A proper fraction | A unit fraction | A mixed number | A mixed number |

- Discuss among the group and select a fraction appropriate for the second number.
- Write the expression of dividing (\div) the first number by the second number.

$$6 \div 2 = 3$$

Determine a number by which 6 should be multiplied to obtain the solution 3 obtained by dividing 6 by 2.

- Considering the above, discuss among the group how an instance involving a division could be converted into one involving multiplication.
- Based on your discussion simplify the division assigned to you.
- Prepare to present your findings at the plenary session.

15. Decimals

Competency 03 : Manipulates units and parts of units under the mathematical operations to easily fulfill the requirements of day to day life.

Competency Level 3.3 : Manipulates decimal numbers under the mathematical operations of multiplication and division.

Activity 3.3 : Let us multiply decimal numbers; let us divide them.

Time : 80 minutes.

Quality Inputs : • Four copies of the instruction leaflet on exploration included in Annex 3.3.1.
• Demy papers and pastels.

Learning – Teaching Process:

Step 3.3.1 : • Obtain the aid of a student to write a decimal number as a fraction and to find the reciprocal of the fraction.
• Lead a discussion and highlight the following facts.

- That a decimal number can be represented as a fraction with a power of 10 as the denominator
e.g. $0.1 = \frac{1}{10}$, $0.03 = \frac{3}{100}$
- That a division of fractions can be converted into a multiplication by using the reciprocal of the divisor

(10 minutes)

Step 3.3.2 : • Divide the class into four small groups.
• Distribute the instructions on exploration, demy papers and pastels among the groups.
• Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
• Engage the small groups in exploration.
• Let the small groups prepare for a presentation at the plenary session.

(30 minutes)

Step 3.3.3 : • Provide each small group with the opportunity to present the findings of the group.
• Give the presenters themselves the first opportunity to elaborate on the presentation.
• Seek for constructive comments from the other groups.
• Engage in a review so that the following facts are highlighted.

- That multiplication and division of decimal numbers can be performed by converting the decimal numbers into fractions
- That when multiplying two decimal numbers, the two numbers should first be multiplied together by ignoring the decimal places, and then the decimal point should be placed based on the sum of the decimal places of the multiplicand and the multiplier
- That when dividing decimal numbers, finding the solution is facilitated by converting the numbers into equivalent fractions
- That when converting the divisor into a whole number in a division by a decimal number, both the divisor and the dividend have to be multiplied by a power of 10

(40 minutes)

Criteria for Assessment and Evaluation:

- Multiplies, divides a whole number by a decimal number.
- Multiplies, divides two decimal numbers.
- Simplifies expressions with decimal numbers using easy methods.
- When solving a problem, selects the best methods by trying out various methods.
- Presents facts to confirm the accuracy of the solution.

Annex 3.3.1

Instructions for group exploration

Let us multiply decimal numbers; let us divide them

| | Case I | Case II | Case III | Case IV |
|-----|-----------------|-----------------|------------------|-------------------|
| (a) | 2×1.5 | 1.5×12 | 3.2×1.3 | 1.25×1.5 |
| (b) | $1.25 \div 1.5$ | $3.2 \div 1.8$ | $3 \div 1.2$ | $2 \div 1.5$ |

- Focus your attention on the case received by your group from the cases given above.
- To simplify the problem in (a), write down the decimal numbers as fractions.
- By following the process of multiplying fractions, simplify the product and write the solution as a decimal number.
- To simplify the problem in (b) too, write the decimal numbers as fractions.
- Now by following the process of dividing fractions, simplify the problem and write the solution as a decimal number.
- Discuss how the above simplifications can be carried out without converting the decimal numbers into fractions, and discuss also about the behaviour of the decimal point in such cases.
- Prepare for a presentation of your findings on multiplying and dividing decimal numbers, at the plenary session.

16. Ratio - I

Competency 04 : Uses ratios to facilitate day to day activities.

Competency Level 4.1 : Uses ratios in day to day activities.

Activity 4.1 : Let us divide things fairly.

Time : 125 minutes.

Quality Inputs :

- A copy of the poster included in Annex 4.1.1.
- Three copies of the instruction leaflet on exploration included in Annex 4.1.2
- Demy papers and pastels.

Learning – Teaching Process:

Step 4.1.1 :

- Present the poster to the class and discuss with the students how the profit in the given situations should be divided.
- During the discussion highlight the following facts.

- That in a business, when equal amounts of cash are invested for equal periods of time, the profits should be divided in the ratio 1:1
- That when unequal amounts of cash are invested for equal periods of time, the profit is divided in the ratio of the amounts invested

(15 minutes)

Step 4.1.2 :

- Divide the class into three small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on part I of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for presentations at the plenary session.

(30 minutes)

Step 4.1.3 :

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That when sharing profits in a business, the amount invested as well as the period of investment should be taken into consideration
- That to obtain the ratio in which the profits should be shared, the amount invested and the period of investment should be multiplied together
- That if P invested a amount of cash for x amount of time, and Q invested b amount of cash for y amount of time, the ratio in which the profits should be divided between P and Q is $ax : by$
- That the obtained ratio should be written in the simplest form
- That when the profits are divided based on the amount invested and the period of investment, each person receives a fair share of the profit

(30 minutes)

Step 4.1.4

- : • Organize the groups again.
- Focus the attention of the groups on part II of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 4.1.5

- : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That the amount each person receives can be determined by dividing the quantity according to the given ratio
- That based on the amount of one fraction of a ratio, the amount of the other fraction can be determined
- That the total quantity can thus be determined
- That based on the amount of one fraction of a ratio, the total quantity can be determined

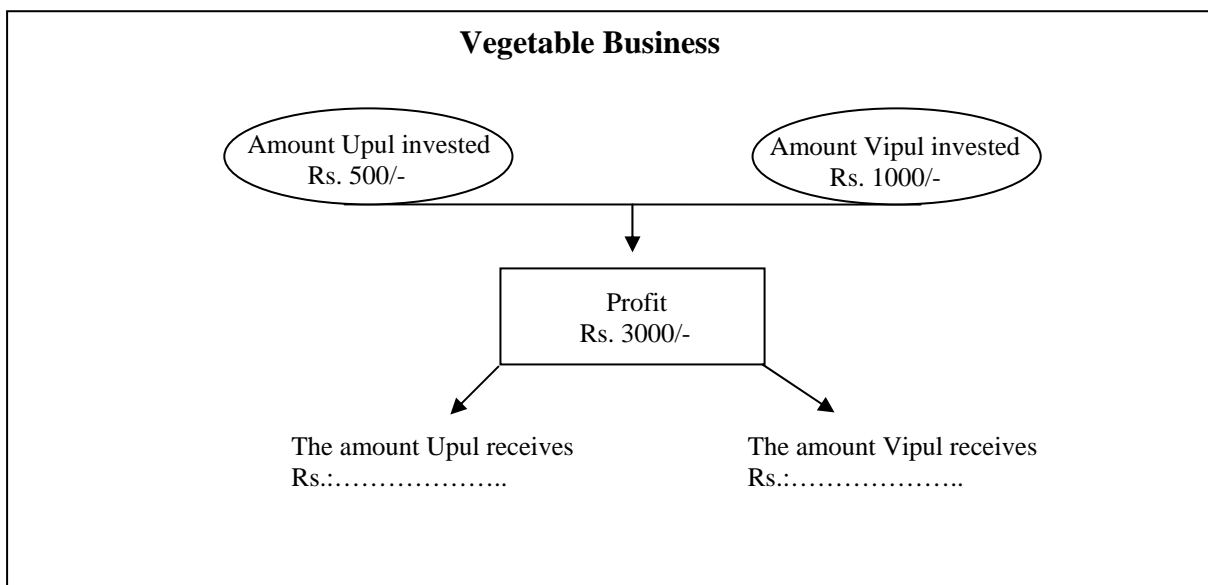
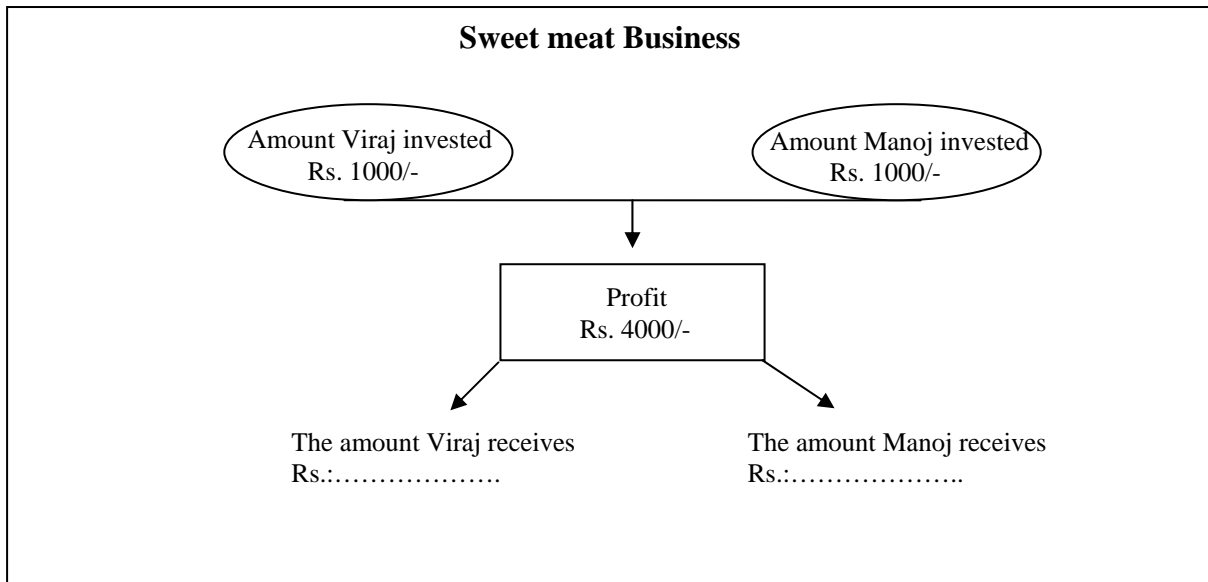
(20 minutes)

Criteria for Assessment and Evaluation:

- Determines the ratio in which profits should be divided when various amounts are invested in a business for equal periods of time.
- Determines the total amount when a ratio and the value of one fraction is known.
- Divides profits based on the amount invested in a business and the period of investment.
- Shares things fairly.
- Minimizes waste in day to day activities.

Annex 4.1.1

Poster



Annex 4.1.2

Instructions for group exploration

Let us divide things fairly

Part I

- The following table gives the manner in which two businessmen Nimal and Kamal invested money in 3 businesses.

| Case | Nimal | | Kamal | | Profit (Rs.) |
|------|-----------------------|---------------|-----------------------|---------------|--------------|
| | Amount Invested (Rs.) | Time (Months) | Amount Invested (Rs.) | Time (Months) | |
| I | 3000 | 12 | 4000 | 6 | 10000 |
| II | 8000 | 10 | 4000 | 12 | 8000 |
| III | 6000 | 20 | 5000 | 12 | 6000 |

- Focus your attention on the amount invested by each businessman and the period of investment, in the case assigned to your group.
- Determine whether the fairest method of dividing the profits they gained is obtained by considering (i) only the amount invested, (ii) only the period of investment, (iii) both the amount invested and the period of investment.
- Propose a suitable ratio according to which the profits could be divided, which is based on a relationship between the amount invested and the period of investment.
- Provide reasons as to why it is fair to divide the profits according to the above ratio.
- Prepare to present your findings at the plenary session.

Part II

- The following table gives the manner in which the profits from a business are divided between A and B in three instances.

| Case | Ratio A:B | Amount A received (Rs.) | Amount B received (Rs.) | Total Profit (Rs.) |
|------|-----------|-------------------------|-------------------------|--------------------|
| I | 2:3 | 200 | ..... | ..... |
| II | 1:4 | ..... | 4000 | ..... |
| III | 2:5 | 800 | ..... | ..... |

- Focus your attention on the ratio and the amount in the case assigned to your group.
- Based on the ratio between A and B, determine what fraction of the total profit each receives.
- Using the amount in the table relevant to one fraction, determine the amount of the other fraction and complete the table.
- Propose another method to obtain the total amount directly, by considering the fraction that one person receives from the total.
- Prepare to present your findings at the plenary session.

16. Ratios - II

- Competency 04** : Uses ratios to facilitate day to day activities.
- Competency Level 4.2** : Solves problems by constructing relationships between two ratios.
- Activity 4.2** : Let us compound two ratios.
- Time** : 75 minutes.
- Quality Inputs** : • Three copies of the instruction leaflet on exploration included in Annex 4.2.1.
• Demy papers and pastels.
- Learning – Teaching Process:**
- Step 4.2.1** : • State that the amount of money that two children in a class have is in the ratio 1:2 and inquire from the students about the amounts that the two children could have. On the blackboard, write down the amounts as ratios also.
• Lead a discussion and highlight the following facts.
- That in a simple ratio, both terms can be multiplied by the same number
 - That by multiplying both the terms of a simple ratio by the same number an equivalent ratio is obtained
- (15 minutes)
- Step 4.2.2** : • Divide the class into three small groups.
• Distribute the instructions on exploration, demy papers and pastels among the groups.
• Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
• Engage the small groups in exploration.
• Let the groups prepare for a presentation at the plenary session.
- (30 minutes)
- Step 4.2.3** : • Provide each small group with the opportunity to present the findings of the group.
• Give the presenters themselves the first opportunity to elaborate on the presentation.
• Seek for constructive comments from the other groups.
• Engage in a review so that the following facts are highlighted.

- That the compound ratio A:B:C can be found when the ratio A:B and either the ratio B:C or the ratio A:C are given
- That the common component of the ratios is used in finding compound ratios
- That if the ratio between A and B is $p : q$ and the ratio between B and C is $q : r$, the compound ratio between A, B, C is $p : q : r$
- That when the common component of two ratios is equal, the compound ratio can be obtained easily
- That when the value of the common component in one ratio is a multiple of the value of the common component of the other ratio, the compound ratio can be found by multiplying the ratio in which value of the common component is not a multiple by the multiplier
- That when the common component in the two ratios is unequal, the compound ratio can be found by taking the least common multiple of the two unequal values of the common component
- That problems can be solved using the compound ratio

(30 minutes)

Criteria for Assessment and Evaluation:

- Writes down the compound ratio when the common component of two simple ratios is equal.
- Determines the compound ratio of two simple ratios when the value of the common component in one ratio is a multiple of the value of the common component in the other ratio.
- Solves problems by finding the compound ratio of two simple ratios when the common component is unequal, by considering the least common multiple of the two values of the common component.
- Is sensitive to the environment.
- Engages in fruitful activities by relating situations.

Annex 4.2.1

Instructions for group exploration

Let us compound two ratios

- The ratios between the Sinhala, Tamil and Muslim populations in three small villages are given in the following three tables.

Village (i)

| S Sinhala | T Tamil | M Muslim |
|--------------|------------|-------------|
| 3 | 2 | |
| | 6 | 5 |

Village (ii)

| S Sinhala | T Tamil | M Muslim |
|--------------|------------|-------------|
| 7 | 2 | |
| | 4 | 3 |

Village (iii)

| S Sinhala | T Tamil | M Muslim |
|--------------|------------|-------------|
| 3 | 2 | |
| | 5 | 2 |

- Focus your attention on the population ratios of the village received by your group.
- Write down the ratio between the Sinhalese and Tamil populations in the village.
- Write down the ratio between the Tamil and Muslim populations in the village.
- Write down 5 ratios each that are equivalent to the above ratios.

| S : T | T : M |
|---------------|---------------|
| : | : |
| : | : |
| : | : |
| : | : |
| : | : |

- Write down a ratio between the Sinhala, Tamil and Muslim populations by considering the above obtained equivalent ratios (using the equivalent ratios in which the Tamil populations are equal).

| Village | Population |
|----------------|-------------------|
| (i) | 5500 |
| (ii) | 6300 |
| (iii) | 8700 |

- By considering the above table, determine the Sinhala, Tamil and Muslim populations in the village received by your group.
- Prepare for a presentation of your findings at the plenary session.

17. Equations

- Competency 17** : Manipulates the methods of solving equations to fulfill the needs of day to day life.
- Competency Level 17.1** : Uses linear equations to solve problems.
- Activity 17.1** : Let us solve equations.
- Time** : 105 minutes.
- Quality Inputs** : • Four copies of the instruction leaflet on exploration included in Annex 17.1.1.
• Demy papers and pastels
- Learning – Teaching Process:**
- Step 17.1.1** : • Inquire from the students about solving an equation of the form $2x + 1 = 9$ and about removing brackets from an algebraic expression of the form $2(x + 3)$.
• Lead a discussion and highlight the following facts.
- That an equation can be solved by using algebraic methods or by using flow charts
 - That axioms are used to solve equations
 - That to remove brackets from an algebraic expression, all the terms within the bracket need to be multiplied by the term outside the bracket
- (15 minutes)
- Step 17.1.2** : • Divide the class into four small groups.
• Distribute the instructions on exploration, demy papers and pastels among the groups.
• Focus the attention of the groups on part I of the instructions on exploration and assign the relevant task to each group.
• Engage the small groups in exploration.
• Let the groups prepare creatively for a presentation at the plenary session.
- (30 minutes)
- Step 17.1.3** : • Provide each small group with the opportunity to present the findings of the group.
• Give the presenters themselves the first opportunity to elaborate on the presentation.
• Seek for constructive comments from the other groups.
• Engage in a review so that the following facts are highlighted.

- That when solving equations with fractional coefficients, to get rid of the denominators of the coefficients, the equation should be multiplied by the least common multiple of the denominators
- That the equation that is obtained after removing the denominators in the coefficients can be solved using previously gained knowledge

(15 minutes)

Step 17.1.4

- : • Organize the groups again.
- Focus the attention of the groups on part II of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 17.1.5

- : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That some mathematical statements can be written as equations
- That by solving the equations the value of the unknowns can be obtained
- That equations can be used to solve problems

(15 minutes)

Criteria for Assessment and Evaluation:

- Solves equations with brackets.
- Solves equations with fractions.
- Easily determines the solutions to problems by constructing and solving equations.
- Approaches success by working with self-confidence.
- Is inclined to solve problems using easy methods.

Annex 17.1.1

Instructions for group exploration

Let us solve equations

Part I

- Focus your attention on the equation received by your group from the following equations.

| | |
|--------------------------------|-------------------------------|
| (1) $\frac{1}{3}x + 5 = 8$ | (2) $\frac{1}{5}x - 1 = 3$ |
| (3) $3 + \frac{1}{2}y = 12$ | (4) $\frac{2}{3}x - 2 = 6$ |

- Make the coefficient of the unknown a whole number by applying your knowledge on fractions.
- Solve the equation.
- Prepare to present how the equation was solved.

Part II

- Focus your attention on the statement received by your group from the following statements.

| | |
|---|--|
| 1 | The price of an orange is Rs. 5 more than the price of a mango. The price of 6 oranges is Rs. 150 |
| 2 | The price of a pen is Rs. 2 less than the price of a book. The price of 8 pens is Rs. 80. |
| 3 | The weight of a chocolate is 30g greater than the weight of a toffee. The weight of 4 such chocolates is 140g |
| 4 | The length of a pen is 4 cm shorter than the length of a pencil. The total length of three such pens is 36 cm. |

- Construct an equation by using any algebraic symbol you like for the value of the item mentioned second in the statement.
- Solve the equation.
- Examine the accuracy of the value obtained for the unknown by substituting it back into the equation.
- Prepare to present the constructed equation and the solution.

18. Percentages - I

Competency 05 : Makes successful transactions in the modern world by using percentages.

Competency Level 5.1 : Develops the relationship between fractions, ratios and percentages

Activity 5.1 : Let us write fractions and ratios as percentages.

Time : 135 minutes.

Quality Inputs :

- An enlarged copy of the announcement leaflet included in Annex 5.1.1
- Four copies of the instruction leaflet on exploration included in Annex 5.1.2.
- Demy papers and pastels.

Learning – Teaching Process:

Step 5.1.1

- Present the announcement leaflet to the class and inquire from the students about the relationships between the numbers in it.
- Lead a discussion and highlight the following facts.

- That fractions with denominator equal to 100 are percentages
- That any fraction can be written as a fraction with denominator equal to 100
- That $\frac{1}{100} = 1\%$
- That a fraction can be converted into a percentage by multiplying it by 100%
- That if the ratio between two quantities is $a:b$, it can also be written as $\frac{a}{b}$

(15 minutes)

Step 5.1.2

- Divide the class into four small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on part I of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 5.1.3

- : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That any fraction can be written as a percentage by multiplying it by 100%
- That any percentage can be written as a fraction with 100 as the denominator

(30 minutes)

Step 5.1.4

- : • Organize the groups again.
- Focus the attention of the groups on part II of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 5.1.5

- : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That a ratio can be represented as a percentage by writing it as a fraction
- That by converting a percentage into a fraction with denominator 100, it can be written as a ratio

(30 minutes)

Criteria for Assessment and Evaluation:

- Expresses a ratio/fraction as a percentage.
- Expresses a percentage as a fraction and as a ratio.
- Converts between fractions, ratios and percentages.
- Uses day-to-day experiences to make comparisons.
- Performs tasks with pride using the obtained results.

Annex 5.1.1

Of the 20 students who sat the G.C.E. (O'level) examination from our school this year, 18 passed. That is, the pass rate was 90%. It has been reported that this is the highest percentage of passes in this zone.

Annex 5.1.2

Instructions for group exploration

Let us write fractions and ratios as percentages

Part I

- Focus your attention on the fraction from Table 1 and the percentage from Table II that is relevant to your group from the following fractions and percentages.

| | | | | | |
|----------------|-----------------|---------------|----------------|---------------|---------------|
| Table I | Fraction | $\frac{2}{5}$ | $1\frac{1}{4}$ | $\frac{7}{5}$ | $\frac{2}{1}$ |
|----------------|-----------------|---------------|----------------|---------------|---------------|

| | | | | | |
|-----------------|-------------------|----|-----|------|----|
| Table II | Percentage | 5% | 40% | 250% | 1% |
|-----------------|-------------------|----|-----|------|----|

- Write the fraction relevant to your group as a percentage.
- Using the result you obtained, study the steps of converting the percentage back into a fraction.
- Based on your observation, convert the percentage you received into a fraction.
- Prepare creatively to present your findings at the plenary session.

Part II

- Focus your attention on the ratio relevant to your group from the ratios given below.

| | | | |
|--------------|--------------|--------------|--------------|
| 3 : 5 | 1 : 4 | 3 : 2 | 4 : 1 |
|--------------|--------------|--------------|--------------|

- Write the ratio you received as a fraction.
- Convert the fraction you obtained into a percentage.
- Using the result you obtained, study the steps of converting the percentage back into a ratio, and write 25% as a ratio.
- Write any other ratio you like, express it as a fraction and convert it into a percentage.
- Creatively prepare for a presentation at the plenary session, regarding converting fractions and ratios into percentages and percentages into fractions and ratios.

18. Percentages - II

Competency 05 : Makes successful transactions in the modern world by using percentages.

Competency Level 5.2 : Solves problems related to percentages.

Activity 5.2 : Let us solve problems related to percentages.

Time : 65 minutes.

Quality Inputs :

- An enlarged copy of the question included in Annex 5.2.1.
- Four copies of the instruction leaflet on exploration included in Annex 5.2.2.
- Demy papers and pastels.

Learning – Teaching Process:

Step 5.2.1

- Present the question included in Annex 5.2.1 to the class.
- Lead a discussion and highlight the following facts.

- That any fraction can be represented as a percentage
- That any percentage can be represented as a fraction

(10 minutes)

Step 5.2.2

- Divide the class into four small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 5.2.3

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That when calculating a certain percentage of a quantity, the quantity should be multiplied by the percentage
- That when $r\%$ of a quantity is given as x , $1\% = \frac{x}{r}$
- That the total quantity can be obtained by $\frac{x}{r} \times 100$

(25 minutes)

Criteria for Assessment and Evaluation:

- Calculates a given percentage of a quantity.
- Determines the total quantity when a percentage and the value of the percentage are given.
- Calculates another percentage when a percentage and the value of the percentage are given.
- Is inclined to solve problems by applying easy methods.
- Works as a team to make the process a success.

Annex 5.2.1**Question**

$\frac{3}{5}$ of the students in Grade 8 are males. Express the number of male students as a percentage of the total number of students in the grade. What is the percentage of female students in the grade?

Annex 5.2.2**Instructions for group exploration****Let us solve problems related to percentages**

- Focus your attention on the problem received by your group.

| | |
|-----------|------------------------|
| Problem 1 | 30% of Rs. 400 |
| Problem 2 | 25% of 800 children |
| Problem 3 | 12% of 500 coconuts |
| Problem 4 | 40% of 650 kg of paddy |

- Obtain the solution by writing the percentage in the problem you received in a suitable manner.
- Discuss the method you followed.
- If the solution you obtained is equal to the given percentage, write down the steps that need to be carried out (inverse process) to obtain the total amount.
- Construct an appropriate problem to obtain the final solution related to the inverse process.
- Solve the problem.
- Prepare creatively for a presentation of your findings at the plenary session.

19. Sets

Competency 30 : Manipulates the principles related to sets to facilitate daily activities.

Competency Level 30.1 : Analyses the various relationships related to sets.

Activity 30.1 : Let us use the symbols that are related to sets.

Time : 90 minutes.

Quality Inputs :

- The chart included in Annex 30.1.1.
- Four copies of the instruction leaflet on exploration included in Annex 30.1.2
- Demy papers and pastels.

Learning – Teaching Process:

Step 30.1.1

- Present the chart to the class and lead a discussion on the groups that can be identified precisely.
- During the discussion highlight the following facts.

- That groups that can be identified precisely are sets
- That the items in such a group are the elements of the set
- That a set can also be written descriptively
- That a set can also be written by listing out its elements
- That a set can be denoted by a capital letter
- That an element in a set is written just once
- That various symbols are used in mathematics

(15 minutes)

Step 30.1.2

- Divide the class into four small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(40 minutes)

Step 30.1.3

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That twin brackets are used to write sets
- That the elements of a set can be represented in a Venn diagram
- That '∈' is used to represent membership in a set
- That '∉' is used to represent the fact that an element does not belong to a set
- That the universal set is the set that contains the elements that belong to all the sets relevant to a given situation
- That the symbol 'ε' is used to denote the universal set
- That the set that contains no elements is the empty set
- That the empty set is denoted by ∅ or by { }
- That the symbol '∅' is from the Danish alphabet
- That the number of elements in the set A is denoted by $n(A)$

(35 minutes)

Criteria for Assessment and Evaluation:

- Denotes whether an element belongs to a set or not using symbols.
- Writes a descriptive sentence using symbols related to sets.
- Analyses sets using various notations and symbols.
- Makes decisions by understanding symbols correctly.
- Aids in classifying various groups.

Annex 30.1.1

Chart

| | | |
|--|-----------------|--------|
| Paintbrush | Buddhist Temple | Pencil |
| Hindu Temple | Pen | Mosque |
| Pastel | Chalk | |
| Items used for writing Paintbrush, Pencil, Pen, Pastel, Chalk | | |
| Places of Worship Buddhist Temple, Hindu Temple, Mosque | | |

| Several Symbols used in Mathematics | |
|--|---|
| For Addition | + |
| For Subtraction | - |
| Is equal | = |
| Is not equal | ≠ |

Annex 30.1.2

Instructions for group exploration

Let us use symbols that are related to sets

- Prime numbers less than 30
- Square numbers less than 50
- Triangular numbers less than 40
- Multiples of five less than 50

- Focus your attention on the set of numbers received by your group.
- Represent the elements of the set described in words in a Venn diagram.
- List out the elements of the set in a row and by studying the textbook use an appropriate pair of brackets to write the set in terms of its elements.
- Name the set using any capital letter you like.
- Write down the answers to the following questions as a sentence that includes the English letter you selected.
 - (a) How many elements are there in this set?
 - (b) Write down an element that belongs to the set.
 - (c) Write down an element that does not belong to the set.
- By studying the textbook, re-write the answers to (a), (b) and (c) using appropriate symbols.
- Propose a suitable name and symbol for the set consisting of all the elements mentioned above.
- Discuss whether the natural numbers that are multiples of 12 and are less than 10 can be written as a set.
- By examining the properties of such a set, and by studying the textbook, propose a suitable name and symbol to define it.
- Prepare to for a creative presentation of your findings at the plenary session.

20. Area - I

- Competency 08** : Makes use of a limited space in an optimal manner by investigating the area.
- Competency Level 8.1** : Finds the area of compound plane figures in the environment and has an awareness of the space allocated for them.
- Activity 8.1** : Let us determine the area of compound plane figures.
- Time** : 135 minutes.
- Quality Inputs** : • Chart of Figures included in Annex 8.1.1.
• Three copies of the instruction leaflet on exploration included in Annex 8.1.2.
• Three straight edges.
• Demy papers and pastels.
- Learning – Teaching Process:**
- Step 8.1.1** : • Present the Chart of Figures to the class.
• Lead a discussion and highlight the following facts.
- That area is a measure of surface space
 - That square centimeter (1 cm^2) and square meter (1 m^2) are units of area
 - That the area of a rectangle is given by length \times breadth
 - That the area of a square of side length a is a^2
 - That triangles can be classified based on their angles and their sides
- (15 minutes)
- Step 8.1.2** : • Divide the class into three small groups.
• Distribute the instructions on exploration, demy papers and pastels among the groups.
• Focus the attention of the groups on Part I of the instructions on exploration and assign the relevant task to each group.
• Engage the small groups in exploration.
• Let them prepare for a presentation at the plenary session.
- (30 minutes)
- Step 8.1.3** : • Provide each small group with the opportunity to present the findings of the group.
• Give the presenters themselves the first opportunity to elaborate on the presentation.
• Seek for constructive comments from the other groups.
• Engage in a review so that the following facts are highlighted.

- That the area of a right-angled triangle is equal to half the area of the rectangle which is formed with the sides forming the right angle of the triangle as adjacent sides of the rectangle
- That the area of a right-angled triangle equals $\frac{\text{product of the sides forming the right angle}}{2}$
- That the area of any triangle is given by $\frac{1}{2} \times \text{altitude} \times \text{base}$

(30 minutes)

Step 8.1.4

- Organize the groups again.
- Focus the attention of the groups on part II of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session. (20 minutes)

Step 8.1.5

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That a compound plane figure can be formed by combining any set plane figures
- That the area of the compound plane figure can be found by determining the area of each of the figures that combine to form it and adding them all up

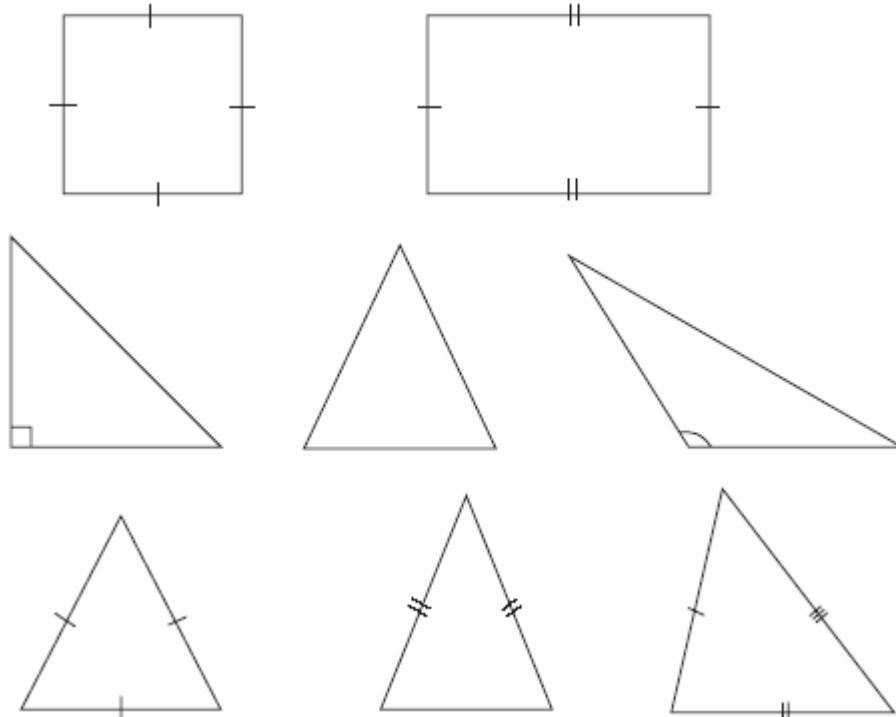
(40 minutes)

Criteria for Assessment and Evaluation:

- Determines the area of a right-angled triangle when the measurements are given.
- Determines the area of a triangle.
- Calculates the area of compound plane figures.
- Uses previous experience in complex situations.
- Easily analyses figures found in day-to-day life.

Annex 8.1.1

Chart of Figures



Annex 8.1.2

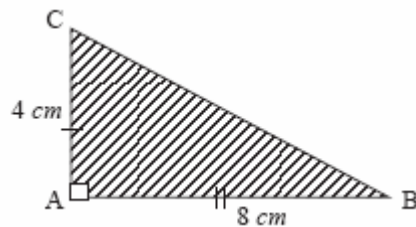
Instructions for group exploration

Let us determine the area of compound plane figures

Part I

1.

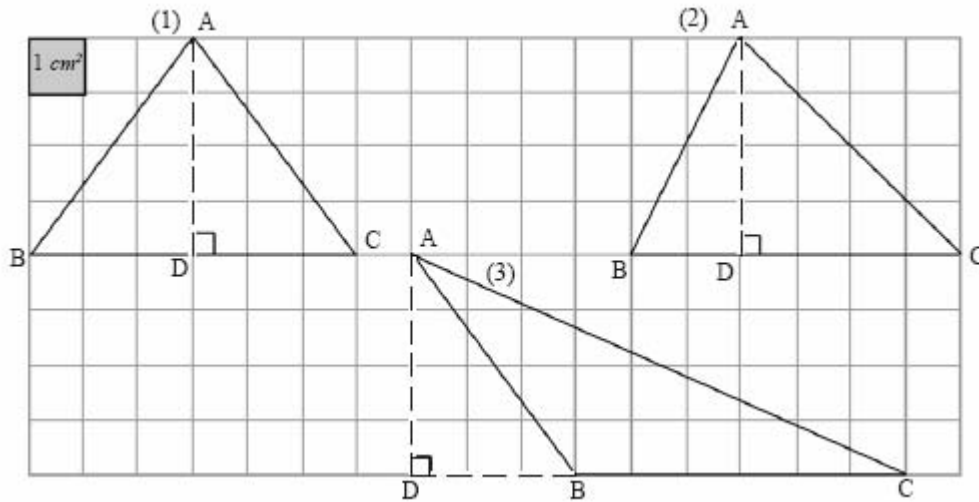
- Focus your attention on the right-angled triangle ABC given below.



- Describe the method of determining the area of the right-angled triangle ABC by means of the area of a rectangle.
- Develop a relationship between the lengths of the sides AB and AC of the right-angled triangle ABC and the area of the triangle.

2.

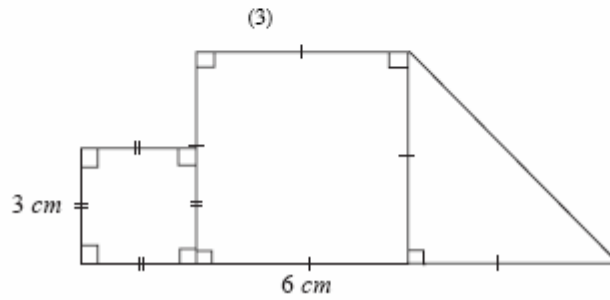
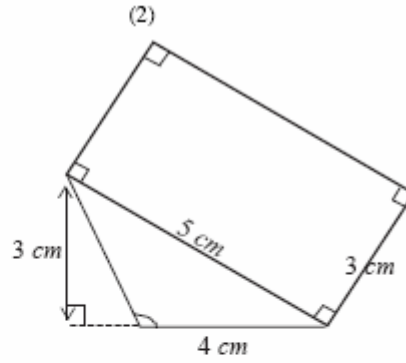
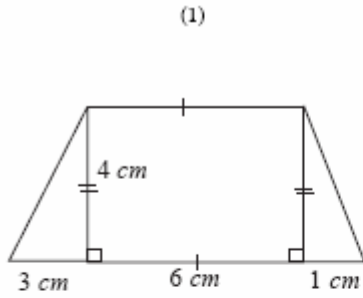
- Focus your attention on the figure received by your group from the figures given below.



- To find the area of the triangle received by your group using right-angled triangles, obtain the necessary measurements from the grid.
- Find the area of the triangle you received by applying the relationship you obtained above to determine the area of a right-angled triangle (in 1.).
- Using the base length BC and the altitude AD of the triangle ABC, work towards obtaining the same answer you obtained above.
- By means of the above, construct a formula based on the altitude and base length, to find the area of any triangle.
- Creatively prepare for a presentation at the plenary session.

Part II

- Focus your attention on the compound plane figure received by your group from the figures given below.



- Calculate the area of the figure by dividing it appropriately into parts, taking into consideration the given measurements.
- Creatively prepare for a presentation at the plenary session.

20. Area - II

- Competency 08** : Makes use of a limited space in an optimal manner by investigating the area.
- Competency Level 8.2** : Fulfills daily needs by investigating the surface area of various solids.
- Activity 8.2** : Let us find the surface area of solids.
- Time** : 80 minutes.
- Quality Inputs** : • Fours solids constructed with nets that can be opened out and made according to the measurements given in Annex 8.2.1
• Four copies of the instruction leaflet on exploration included in Annex 8.2.1.
• Demy papers and pastels
- Learning – Teaching Process:**
- Step 8.2.1** : • Display a square with sides of length l and a rectangle with length l and breadth b on the board and inquire from the students about their shapes and their area.
• Lead a discussion and highlight the following facts.
- | |
|--|
| <ul style="list-style-type: none"> • That if the area of a rectangle of length l and breadth b is A, then $A = l \times b$ • That if the area of a square with sides of length l is A, then $A = l^2$ |
|--|
- (10 minutes)
- Step 8.2.2** : • Divide the class into four small groups.
• Distribute the instructions on exploration, relevant solid, demy papers and pastels among the groups.
• Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
• Engage the small groups in exploration.
• Let the groups prepare for a presentation at the plenary session.
- (35 minutes)
- Step 8.2.3** : • Provide each small group with the opportunity to present the findings of the group.
• Give the presenters themselves the first opportunity to elaborate on the presentation.
• Seek for constructive comments from the other groups.
• Engage in a review so that the following facts are highlighted.

- That a cube has 6 identical faces
- That to easily determine the total surface area of a cube, the area of one face should be multiplied by six
- That a cuboid has three pairs of faces, each pair being identical
- That the total surface area of a cuboid could be obtained by adding of the areas of the 3 distinct faces and multiplying it by two

(35 minutes)

Criteria for Assessment and Evaluation:

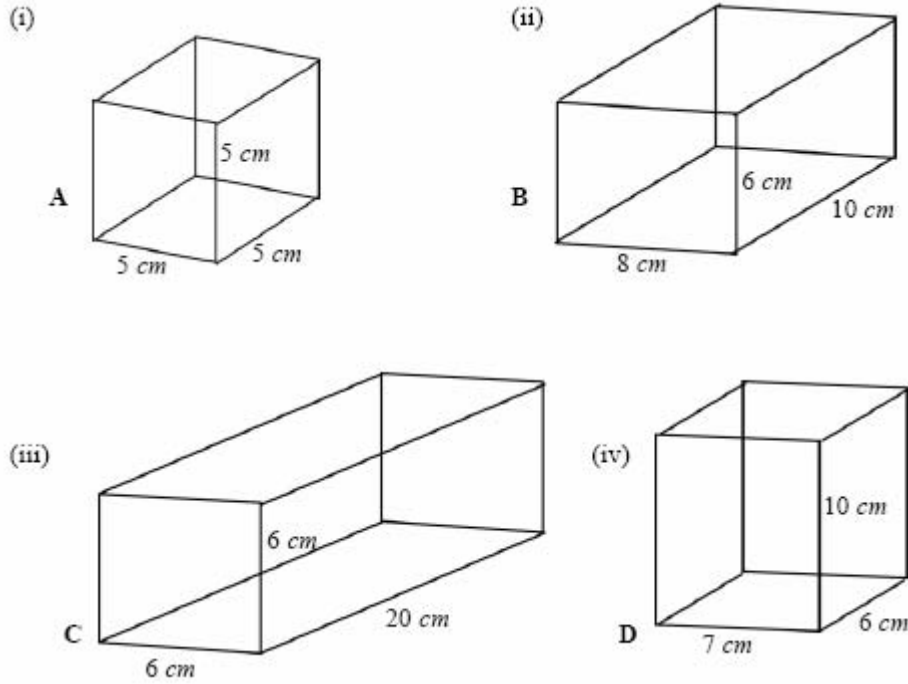
- Obtains the surface area of a cube/cuboid by adding up the areas of all the faces.
- Determines the surface area of a cube/cuboid by considering the areas of the identical faces.
- Calculates the total surface area of a cube/cuboid by using a minimum number of measurements.
- Applies generalized results to special cases.
- Works as a team to ensure the success of the process.

Annex 8.2.1

Instructions for group exploration

Let us determine the surface area of solids

- Focus your attention on the solid received by your group from the solids given below.



- Open out the solid received by your group and cut out all the faces (without the pasting allowance).
- Measure the length and breadth of each of the faces to the nearest centimeter.
- Discuss about the shape of each of the faces, draw each face and separately calculate each area.
- Calculate the total surface area of the solid using the above calculated areas.
- Propose an easier method to determine the total surface area using a minimum number of measurements.
- Prepare to present of your findings creatively at the plenary session.

21. Time - I

Competency 12 : Fulfills the needs of the world of work by time management.

Competency Level 12.1 : Investigates the rotation of the earth and inquires into its results.

Activity 12.1 : Let us examine time zones.

Time : 70 minutes.

Quality Inputs :

- A copy of the figure included in Annex 12.1.1.
- Four copies of the instruction leaflet on exploration included in Annex 12.1.2.
- Illustrative World globe and four world maps.
- Demy papers and pastels.

Learning – Teaching Process:

Step 12.1.1

- Present the figure, world globe and world map to the class and lead a discussion on the earth's rotation.
- During the discussion highlight the following facts.

- That the earth's axis of rotation is inclined at an angle of $23\frac{1}{2}^{\circ}$ from the vertical
- That the imaginary line which divides the earth into the northern hemisphere and the southern hemisphere is the **equator**
- That lines of latitude are imaginary lines parallel to the equator
- That lines of longitude are imaginary lines that proceed from the North Pole to the South Pole
- That the 0° line of longitude passes through the town Greenwich in the United Kingdom
- That the 0° line of longitude is called the **Greenwich Meridian Line**
- That the West longitudes lie on the west of the Greenwich Line and the East longitudes lie on the east of the Greenwich Line
- That the earth rotates in the direction of the east.
- That the time at a location changes due to the earth's rotation
- That Sri Lanka lies between the East longitudes of 79° and 82°
- That the 180° line of longitude is called the **International Date Line (IDL)**

(15 minutes)

Step 12.1.2

- Divide the class into four small groups.
- Distribute the instructions on exploration, world maps, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session. (30 minutes)

Step 12.1.3

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That the earth takes 4 minutes to rotate 1°
- That the earth rotates 15° in one hour
- That the 0° line of longitude has been used as the base for the time zones
- That the **time zones** are 15° strips of land with the lines of longitude $0^\circ, 15^\circ, 30^\circ, 45^\circ, \dots$ as their centres
- That the **0 time zone** is the area lying on the two sides of the 0° line of longitude from $7\frac{1}{2}^\circ$ west to $7\frac{1}{2}^\circ$ east
- That the time zones are separated out in the following manner

$37\frac{1}{2}^\circ$ $22\frac{1}{2}^\circ$ $7\frac{1}{2}^\circ$ $7\frac{1}{2}^\circ$ $22\frac{1}{2}^\circ$ $37\frac{1}{2}^\circ$
 $\underbrace{\hspace{1.5cm}}_{-2}$ $\underbrace{\hspace{1.5cm}}_{-1}$ $\underbrace{\hspace{1.5cm}}_0$ $\underbrace{\hspace{1.5cm}}_{+1}$ $\underbrace{\hspace{1.5cm}}_{+2}$

- That the time zones from the Greenwich Meridian Line up to the International Date Line are positive to the east and negative to the west of the Greenwich Meridian Line
- That the time difference between two consecutive time zones is 01 hour
- That the time zone that a country belongs to can be determined by dividing its longitude value by 15
- That Sri Lanka belongs to the $+5\frac{1}{2}$ time zone of the Madras sub-zone

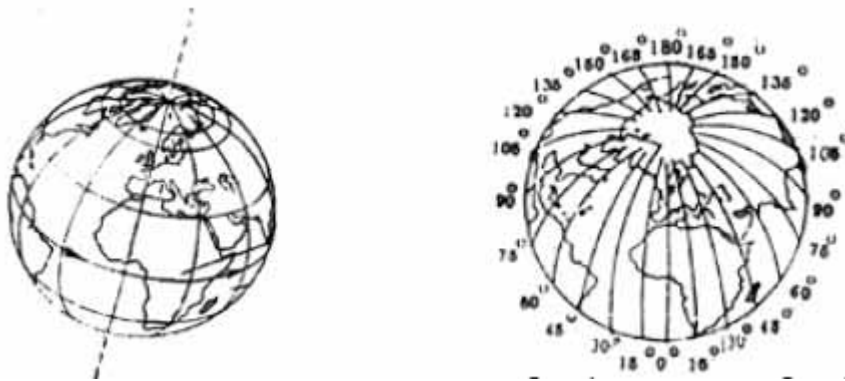
(25 minutes)

Criteria for Assessment and Evaluation:

- Determines the time zone that a country belongs to based on its longitudinal coordinate.
- Determines the limits of a time zone.
- Expresses the time zone that a country belongs to based on its location.
- Does explorative studies of information.
- Is inclined to investigate international information.

Annex 12.1.1

Figure



Western Longitudes Eastern Longitudes

Annex 12.1.2

Instructions for group exploration

Let us examine time zones

The time taken by Earth to rotate once about its axis is 24 hours or 1 day

- Focus your attention on the facts in the above statement and determine the time taken for the Earth to rotate 1° and the number of degrees it rotates in an hour.

A time zone is a strip of land of 15° between certain lines of longitude

- Study the facts in the following table carefully.

| | | | | | |
|----------------------------|---|--|---|--|---|
| Longitude | 30° West | 15° West | 0° GMT | 15° East | 30° East |
| Time Zone | -2 | -1 | 0 | +1 | +2 |
| Longitudinal Limits | $37\frac{1}{2}^{\circ}$ W - $22\frac{1}{2}^{\circ}$ W | $22\frac{1}{2}^{\circ}$ W - $7\frac{1}{2}^{\circ}$ W | $7\frac{1}{2}^{\circ}$ W - $7\frac{1}{2}^{\circ}$ E | $7\frac{1}{2}^{\circ}$ E - $22\frac{1}{2}^{\circ}$ E | $22\frac{1}{2}^{\circ}$ E - $37\frac{1}{2}^{\circ}$ E |

- By using the textbook, collect information on longitudes and time zones.
- By considering the collected information, develop relationships between the longitudes, time zones and limits given in the table.
- Focus your attention on the set assigned to your group from the following sets.

| | | | | |
|----------------------------|-------------------|-------------------|-------------------|-------------------|
| Sets | I | II | III | IV |
| Longitude | 135° west | ..... | 90° east | ..... |
| Time Zone | ..... | -6 | ..... | +10 |
| Longitudinal Limits | from to | from to | from to | from to |

- Complete the column assigned to your group based on the relationships you developed between the longitude, time zone and limits.
- By studying the facts in the table, discuss how the time zone a country belongs to can be determined based on its longitudinal coordinate.
- Sri Lanka lies between the lines of longitude 79°E and 82°E. Based on the facts that you discovered above, determine the time zone that Sri Lanka belongs to.
- Prepare to present your findings at the plenary session.

21. Time - II

- Competency 12** : Fulfills the needs of the world of work by time management.
- Competency Level 12.2** : Investigates the difference in time between countries and finds their relative positions.
- Activity 12.2** : Let us find the time which changes from country to country.
- Time** : 135 minutes.
- Quality Inputs** :
- Four copies of the time zone map included in Annex 12.2.1 and an enlarged copy of it.
 - Four copies of the instruction leaflet on exploration included in Annex 12.2.2.
 - Illustrative World globe.
 - Demy papers and pastels.

Learning – Teaching Process:

- Step 12.2.1** :
- Present the enlarged copy of the time zone map and the world globe to the class and lead a discussion by presenting the following statement.
 “The international test cricket match between the West Indies and Sri Lanka to be held in the National Stadium in the West Indian town of Guyana on 2008.03.21 will commence at 1000h local time. The commencement of the match can be viewed live on Sri Lankan television at 1930h that day.”
 - During the discussion highlight the following facts.

- That the **Greenwich Meridian Line** is the 0° line of longitude that falls across the town Greenwich in England.
- That the western lines of longitude spread west from the Greenwich Meridian Line to the 180° line of longitude and the eastern lines of longitude spread east from the Greenwich Meridian Line to the 180° line of longitude
- That the 180° line of longitude is called the **International Date Line** or the IDL
- That the 0 time zone is the strip of land of 15° with the Greenwich Meridian Line at the centre
- That time zones of 15° have been separated out based on this

- That the time zones to the left of the Greenwich Meridian Line are separated out as the -1, -2, -3, -12 time zones, and the time zones to the right of the Greenwich Meridian Line are separated out as the +1, +2, +3, +12 time zones
- That the 12th time zone in the eastern longitude hemisphere is the +12 time zone and the 12th time zone in the western longitude hemisphere is the -12 time zone
- That since the time taken for Earth to rotate 1° about its axis is $\frac{24 \times 60}{360} = 04$ minutes, the Earth takes 1 hour to rotate 1 time zone
- That since the Earth rotates in the direction of the East, there is a difference of 1 hour in a time zone

(20 minutes)

Step 12.2.2

- Divide the class into four small groups.
- Distribute the instructions on exploration, time zone world maps, demy papers and pastels among the groups.
- Focus the attention of the groups on part I of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 12.2.3

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That Colombo which lies at East longitude 80° belongs to the time zone $\frac{80}{15} = +5\frac{1}{3}$
- But that in practice it is taken that Sri Lanka belongs to the Madras time zone of $+5\frac{1}{2}$
- That since Sri Lanka lies in the $+5\frac{1}{2}$ time zone, it is $5\frac{1}{2}$ hours ahead of the Greenwich Meridian Time

- That the difference in time between a country and GMT can be obtained based on its longitudinal coordinates
- That based on the location of a country, the time in any other country could be found by adding from its time zone towards the right and subtracting from its time zone toward the left

(25 minutes)

Step 12.2.4

- Organize the groups again.
- Focus the attention of the groups on part II of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(35 minutes)

Step 12.2.5

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That when defining the standard time relevant to each country based on GMT, there are two occasions when the date can change
- That one instance is when 24 hours is completed and a new day begins
- That the other instance is when the IDL is passed
- That when passing the IDL from East to West you move a day back and when passing the IDL from West to East you move a day forward

(25 minutes)

Criteria for Assessment and Evaluation:

- Expresses the time in any country in relation to the Greenwich Meridian Time by considering the time zones.
- Calculates the time in another country in relation to the time in Sri Lanka, including the beginning of a new day.
- Compares the time in different countries including changes in date.
- Is inclined to study facts that are related to the universe.
- Makes an effort to develop international relationships.

Annex 12.2.1

Map of Time Zones

Instructions for group exploration

Let us find the time which changes from country to country



Annex 12.2.2

Part I

- Focus your attention on the country received by your group from the countries given below.
 - United States of America (City of Chicago) Western longitude of 90° , time zone -6 .
 - West Indies (Trinidad) Western longitude of 61° , time zone -4 .
 - Thailand (Bangkok) Eastern longitude of 100° , time zone $+7$.
 - Australia (Melbourne) Eastern longitude of 145° , time zone $+10$.
- Study the relationship between the Greenwich Meridian Time (GMT) and the time in the country received by you, based on the longitudinal coordinate of the city and the time zone the city belongs to.
- Obtain the time in the country you received when the Greenwich Meridian Time is 1200h, using the time zone map as well as by calculating it.
- Determine a method of finding the time in the country you received when the time in Sri Lanka is 1000h.
- Prepare to present your findings creatively at the plenary session.

Part II

- Complete the following table of dates, days and times in the countries belonging to the different time zones when the Greenwich Meridian Time on Sunday 2008.03.30 is 1900h.

| | | | | | | | | | | | | | | | | | | | | |
|--------------------------------------|----|----|----|----|----|----|----|----|----|--------|----|----|----|----|----|----|----|----|----|-----|
| The time zone the country belongs to | -9 | -8 | -7 | -6 | -5 | -4 | -3 | -2 | -1 | 0 | +1 | +2 | +3 | +4 | +5 | +6 | +7 | +8 | +9 | +10 |
| Date | | | | | | | | | | 30 | | | | | | | | | | |
| Day | | | | | | | | | | Sunday | | | | | | | | | | |
| Time | | | | | | | | | | 1900h | | | | | | | | | | |

- Focus your attention on the county assigned to your group and the information on it given in the table below.

| | | | | |
|-------------------------|-------------------|--------------------------|----------------|-------------------|
| Group | (i) | (ii) | (iii) | (iv) |
| Time Zone | -5 | -3 | +4 | +8 |
| Country and City | Canada Toronto | Brazil Rio de Janeiro | U.A.E Dubai | China Shanghai |
| Date | | | | |
| Day | | | | |
| Time | | | | |

- Determine the date, day and time in the country assigned to your group when the time in the city of Vancouver in Canada which belongs to the time zone -8 is 2200h on Sunday 2008.03.23.

- Determine the date, day and time in the country assigned to you when the time in Sri Lanka on Thursday 2008.03.27 is 2200h.
- Discuss among the group how the date can change depending on the time zone.
- Find out other instances when the date can change by focusing on the International Date Line (IDL) and the facts you found out when filling in the above table.
- Prepare to present your findings creatively at the plenary session.

22. Volume and Capacity - I

Competency 10 : Gets the maximum out of space by working critically with respect to volume.

Competency Level 10.1 : Determines for daily needs, the space that is taken up by various solids.

Activity 10.1 : Let us construct formulae for the volume.

Time : 75 minutes.

Quality Inputs :

- Three copies of the instruction leaflet on exploration included in Annex 10.1.1.
- 30, 24 and 36 centi-cubes each.
- A cube and a cuboid.
- Demy papers and pastels.

Learning – Teaching Process:

Step 10.1.1 :

- Present the cube, cuboid and centi-cube to the class and engage in a discussion on volumes by considering the length, breadth and height of each item.
- During the discussion, highlight the following facts.

- That the length of a side of a centi-cube is 1 *cm*
- That the volume of a centi-cube is 1 cm^3
- That volume is the amount of space occupied by a solid
- That the standard units of volume are cm^3 and m^3
- That the volume is sometimes obtained by estimation

(15 minutes)

Step 10.1.2 :

- Divide the class into three small groups.
- Distribute the instructions on exploration, centi-cubes, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 10.1.3 :

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.

- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That the volume of a cube is obtained by length \times breadth \times height
- That if the volume of a cuboid of length a , breadth b and height l is v , then $v = abl$
- That if the length of a side of a cube is a and the volume of the cube is v , then $v = a^3$
- That the volume of a cube or cuboid is obtained by multiplying the area of the base by the height

(30 minutes)

Criteria for Assessment and Evaluation:

- Constructs the formula to find the volume of a cuboid when the length, breadth and height of the cuboid are known.
- Writes down the formula to determine the volume of a cube when the length of a side of the cube is known.
- Determines the volume of a cuboid when the area of the base and the height are known.
- Accurately manipulates the instruments in constructions.
- Makes right decisions.

Annex 10.1.1

Instructions for group exploration

Let us construct formulae for the volume

| Case | Centi-cube |
|------|------------|
| 1 | 30 |
| 2 | 24 |
| 3 | 36 |

- Consider the case received by your group from the cases given above.
- Construct a cuboid using all the centi-cubes.
- Based on the number of centi-cubes used, fill in the first row of the following table

| Form | Length | Breadth | Height | Area of Base | Volume |
|------|--------|---------|--------|--------------|--------|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| | | | | | |
| | | | | | |

- Write down the volume of the created solid in terms of the number of centi-cubes used.
- Obtained the volume of the constructed cuboid in terms of its length, breadth and height.
- In the above manner and using the same number of centi-cubes, create other cuboids with different lengths, breadths and heights.
- Using the created cuboids, complete as many rows of the above table as you can.
- For each of the cases, determine the volume in terms of the length, breadth and height.
- If the volume of a cuboid of length a , breadth b and height l is v , construct a formula for v in terms of a , b and l .
- Create a cube by using as many centi-cubes as required.
- Obtain a relationship for the volume in terms of the length of a side.
- If the length of a side of the cube is a , obtain a formula for the volume of the cube in terms of a .
- Construct a relationship to obtain the volume using the area of the base stated in the table.
- Write down a formula for the volume based on this relationship.
- Prepare to present your findings creatively at the plenary session.

22. Volume and Capacity - II

Competency 11 : Fulfills daily needs by working critically with the knowledge of liquid measures.

Competency Level 11.1 : Facilitates daily work by investigating the capacity of liquid containers.

Activity 11.1 : Let us identify the difference between capacity and volume.

Time : 75 minutes.

Quality Inputs :

- Three glass bottles with the capacity indicated on them.
- Three bottles with the same capacities as the above three bottles, having a tape pasted on each but without the measure indicated, filled to $\frac{1}{4}$, $\frac{1}{2}$, $\frac{1}{8}$ of their respective capacities.
- Mathematics textbook.
- Three other vessels filled with the required amount of water.
- An enlarged copy of the news item included in Annex 11.1.1.
- Three copies of the instruction leaflet on exploration included in Annex 11.1.2.
- Demy papers and pastels.

Learning – Teaching Process:

Step 11.1.1 :

- Present the news item to the class and obtain the students' ideas regarding it.
- Lead a discussion and highlight the following facts.

- That the units of liquid measure are millilitres (*ml*) and litres (*l*)
- That $1000\text{ ml} = 1\text{ l}$
- That what remains in a tank is a volume of water
- That if there is liquid in a vessel, it is defined as a volume of liquid
- That when a vessel is completely filled with water, the volume of the vessel is equal to the volume of water

(15 minutes)

Step 11.1.2 :

- Divide the class into three small groups.
- Distribute the instructions on exploration, a bottle each with the capacity indicated on it, a bottle each with water in it but with the capacity and the measure not indicated on it, a vessel of water each, demy papers and pastels.

- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the small groups prepare for a presentation at the plenary session.

(30 minutes)

Step 11.1.3

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That the total volume of water with which a vessel can be filled can be estimated by using a specific volume of water
- That the total volume of liquid with which a vessel can be filled is the **capacity** of the vessel

(30 minutes)

Criteria for Assessment and Evaluation:

- Estimates the capacity.
- Explains the difference between volume and capacity.
- Solves problems related to capacity.
- Discovers facts by analysis.
- Logically comes to conclusions regarding day to day things.

Annex 11.1.1**A Television News Item**

The water level in Victoria, Randenigala, Rantambe have reduced at a rapid rate due to the severe drought experienced during the recent past

Annex 11.1.2

Instructions for group exploration

Let us identify the difference between capacity and volume

- From the set of items that has been provided, select the bottle with the capacity indicated on it, the bottle with the liquid in it and the vessel with water in it.
- On the pasted strip of paper, mark the water level of the water in the bottle.
- Estimate how many times the bottle with water in it should be used to completely fill the bottle with the capacity indicated on it.
- Confirm the estimated value by filling the bottle with the capacity indicated on it.
- By studying the textbook, propose a suitable name for the total volume of water the vessel holds when it is completely filled.
- Solve the problem assigned to your group from the problems given below.

Problem i - A bottle of capacity 900 ml is completely filled with medicinal oil. How many vials of capacity 75 ml can be filled using the oil in the bottle?

Problem ii – Determine the ratio between the capacities of a cube with sides of length 10 cm and a cube with sides of length 20 cm .

Problem iii – How many bottles of capacity 400 ml can be filled by a 5 l volume of drink? What is the volume of liquid that remains?

- Prepare for a presentation at the plenary session.

23. Circle

Competency 24 : Thinks logically to make decisions based on geometrical concepts related to circles.

Competency Level 24.1 : Inquires into the special properties related to circles.

Activity 24.1 : Let us identify the special features of a circle.

Time : 50 minutes.

Quality Inputs :

- A copy of the Figure included in Annex 24.1.1.
- Four copies of the instruction leaflet on exploration included in Annex 24.1.2.
- Compasses.
- Demy papers, half-sheets and pastels.

Learning – Teaching Process:

Step 24.1.1 :

- Present the figure in Annex 24.1.1 to the class.
- Lead a discussion and highlight the following facts.

- That a **circle** is the path of a point that travels a constant distance from a fixed point
- That the fixed point is the **centre** of the circle
- That the distance from the fixed point to the circle is the **radius** of the circle
- That the longest line that can be drawn between two points on a circle is a **diameter** of the circle
- That a diameter passes through the centre of the circle

(10 minutes)

Step 24.1.2 :

- Divide the class into four small groups.
- Distribute the instructions on exploration, compasses, demy papers, half-sheets and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the small groups prepare for a presentation at the plenary session.

(20 minutes)

Step 24.1.3 :

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.

- Engage in a review so that the following facts are highlighted.

- That a straight line joining two points on a circle is a **chord**
- That the two parts of a circle that are separated out by a chord are called **segments of the circle**
- That the part of a circle separated out by two radii and an arc of the circle is called a **sector of the circle**
- That a diameter of a circle is an axis of symmetry of the circle
- That a circle has many axes of symmetry

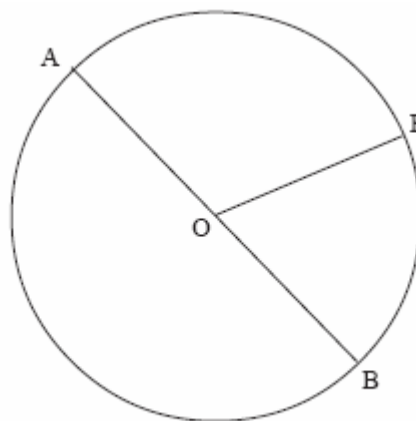
(20 minutes)

Criteria for Assessment and Evaluation:

- Names chords of a circle.
- Indicates the difference between a segment of a circle and a sector of a circle.
- Analyses the special features of the various parts of a circle.
- Critically considers the opinions of the other groups.
- Works in corporation within the group.

Annex 24.1.1

Figure



Annex 24.1.2

Instructions for group exploration**Let us identify the special features of a circle**

| | |
|---------------------------|----------------------------|
| (1) Radius of 7 <i>cm</i> | (2) Radius of 8 <i>cm</i> |
| (3) Radius of 9 <i>cm</i> | (4) Radius of 10 <i>cm</i> |

- On the given demy paper, draw two circles of radius the value received by your group from the values given above.
- Draw a circle of the same radius on a half-sheet also.
- Draw a straight line segment AB of length 12 *cm* such that it intersects with one of the circles drawn on the demy paper at the points A and B
- By studying the textbook or by some other method, propose suitable names for
 - AB.
 - the two parts that the circle is separated into by AB.
- Separate out a part of the other circle drawn on the demy paper using two radii.
- By studying the textbook or by some other method, propose a name for this part.
- Cut out the circle drawn on the half-sheet, study its symmetry and note down its special features on the demy paper.
- Prepare for a presentation at the plenary session.

24. Location

Competency 13 : Uses scale drawings in practical situations by exploring various methods.

Competency Level 13.1 : Indicates the direction of a location using angles.

Activity 13.1 : Let us indicate locations using directions.

Time : 120 minutes.

Quality Inputs :

- Four protractor instruments prepared before hand as indicated in Annex 13.1.1 (with protractor 1 and protractor 2).
- Four copies of the instruction leaflet on exploration included in Annex 13.1.2.
- Four compasses.
- Demy papers and pastels.

Learning – Teaching Process:

Step 13.1.1 :

- Take the students outside the classroom and lead a discussion by inquiring from them about the direction of the North from their location.

- During the discussion highlight the following facts.

- That the direction of the North could be determined by considering the direction the sun rises from
- That the North can be determined accurately by using a compass

(20 minutes)

Step 13.1.2 :

- Divide the class into four small groups.
- Distribute the instructions on exploration, protractor instruments, compasses, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant place and task to each group.
- Engage the small groups in exploration.
- Let the small groups prepare for a presentation at the plenary session.

(60 minutes)

Step 13.1.3 :

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.

- Engage in a review so that the following facts are highlighted.

- That the location of a place can be indicated based on the North and the South
- That a places can be describes as 'to the west from the North', 'to the east from the North', 'to the west from the South' and 'to the east from the South'
- That the location is indicated with the first letter of the directions on the two sides and the angle in-between
e.g. N 35° E, S 50° W
- That location also can be indicated based on the North
- That this method of indicating the location is called bearings
- That in determining bearings, angles are measured in a clockwise direction from the North
- That the value of the angle is written using three digits
- That only horizontal measurements are used for bearings

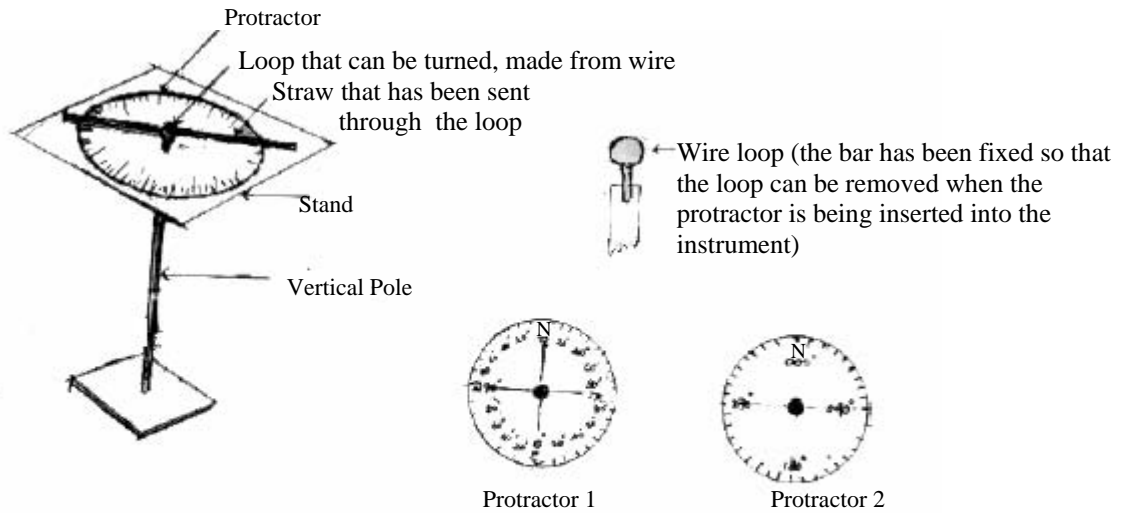
(40 minutes)

Criteria for Assessment and Evaluation:

- Indicates the direction of a location from a specific point, based on the North or the South.
- Indicates the direction of a location from a specific point using bearings.
- Indicates the location of a place from a specific point using various methods.
- Applies various methods to obtain information.
- Is inclined towards making improvements to instruments to obtain successful results.

Annex 13.1.1

Protractor Instrument



- Instructions for the use of the instrument
 - The straw can be sent through the loop
 - The loop can be removed from the vertical pole when required
 - The required protractor can be inserted into the instrument by removing the loop.
- Special Instructions
 - Provide each group with a protractor instrument and a Bristol board with Protractor-1 and Protractor-2 drawn on it.

Annex 13.1.2

Instructions for group exploration

Let us indicate locations using directions

- Place P
- Place Q
- Place R
- Place S

- By considering the direction that the sun rises from, mark the four main directions at the location assigned to your group from the locations given above.
- Using the compass, examine the accuracy of the directions you marked.
- Focus your attention on the measurements on Protractor – 1 and Protractor – 2 received by you with the Protractor Instrument.
- Select 5 trees that can be observed at a distance from the place you are at.
- Fix the Protractor Instrument at the location assigned to you so that the stand is in a horizontal position. Fix Protractor – 1 in the instrument and confirm using the compass that the directions indicated on it and the directions marked at the location coincide with each other.
- By observing the selected trees through the straw, obtain the angles of the directions that they lie in using the protractor and enter them in the following table.

| Name of the tree that was observed | Direction obtained from Protractor - 1 | | | Direction obtained from Protractor - 2 | |
|------------------------------------|--|--------------------|-----------------|--|--------------------|
| | Initial Direction | Angle | Final Direction | Initial Direction | Angle |
| 1 | | ^o |  | ..... | .....^o |
| 2 | | ^o |  | ..... | .....^o |
| 3 | | ^o |  | ..... | .....^o |
| 4 | | ^o |  | ..... | .....^o |
| 5 | | ^o |  | ..... | .....^o |

- Remove Protractor – 1 from the instrument and insert Protractor - 2. As before, confirm the accuracy of the directions, observe the 5 trees and enter the angles that they lie in the above table.
- Examine the relationship between the two methods of indicating the identical direction obtained on the two occasions.
- By studying the textbook, find a suitable name for the method of indicating the direction as in the second occasion using Protractor – 2, and also find out its properties.
- Propose ways in which the instrument can be improved further so that the direction of various locations can be obtained.
- Prepare to present your findings at the plenary session.

25. Number line and Cartesian plane - I

Competency 20 : Easily communicates the mutual relationships that exist between two variables by exploring various methods.

Competency Level 20.1 : Uses a number line to represent fractions and decimal numbers.

Activity 20.1 : Let us represent fractions and decimals on a number line.

Time : 75 minutes.

Quality Inputs :

- A copy of the figure included in Annex 20.1.1.
- Three copies of the instruction leaflet on exploration included in Annex 20.1.2.
- Graph paper.
- Demy papers and pastels.

Learning – Teaching Process:

Step 20.1.1 :

- Present the figure of a number line to the class and inquire from the students about the numbers represented by the points indicated on the line.
- Lead a discussion and highlight the following facts.

- That an integer can be represented by a point on a number line
- That consecutive integers are integers that are next to each other
- That 0 is also called **zero**

(15 minutes)

Step 20.1.2 :

- Divide the class into three small groups.
- Distribute the instructions on exploration, graph papers, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the small groups prepare for a presentation at the plenary session.

(30 minutes)

Step 20.1.3 :

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.

- Engage in a review so that the following facts are highlighted.

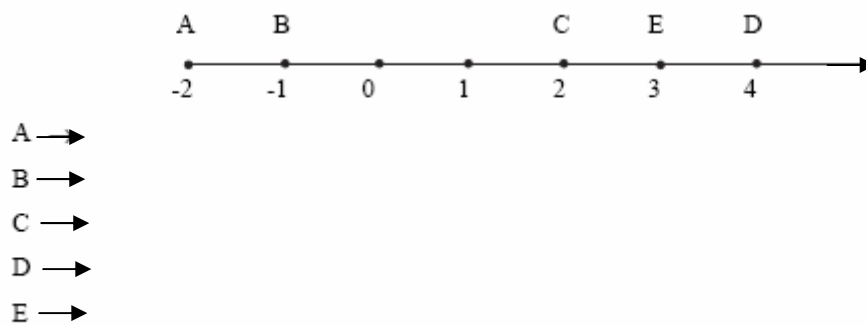
- That there is a specific position on a number line to represent a given decimal number
- That there is a specific position on a number line to represent a given fraction
- That there is a specific position on a number line to represent a given directed number
- That directed numbers can be compared after they are represented on a number line

(30 minutes)

Criteria for Assessment and Evaluation:

- Marks and names numbers that are between two consecutive integers on a number line.
- Accurately represents a decimal number with one decimal place on a number line.
- Provides reasons for the fact that any directed number can be represented on a number line.
- Comes to correct conclusions with reasons.
- Uses pictorial representations in complex tasks.

Annex 20.1.1



Annex 20.1.2

Instructions for group exploration**Let us represent fractions and decimals on a number line**

- Find out about the numbers that lie between the numbers 0 and 1 and between the numbers 1 and 2.
- Find a fraction and a decimal number that lie between the given numbers.
- Focus your attention on the group of numbers received by your group from the following groups of numbers.

| Group | Numbers | | |
|-------|-----------------|-----------------|-----------------|
| 1 | 0.2 | 0.5 | 0.8 |
| 2 | $1\frac{1}{4}$ | $1\frac{1}{2}$ | $1\frac{3}{4}$ |
| 3 | -0.2 | -0.5 | -0.8 |
| 4 | $-1\frac{1}{4}$ | $-1\frac{1}{2}$ | $-1\frac{3}{4}$ |

- Find out the two consecutive integers between which all the numbers you have received lie.
- On the given graph paper, prepare a number line which is suitable to represent the assigned numbers, with the unit divided into equal parts.
- Represent the numbers on the number line and name them.
- Determine the numbers that are closest to and furthest from zero and name them.
- Prepare for a presentation at the plenary session.

25. Number line and Cartesian plane - II

Competency 20 : Easily communicates the mutual relationships that exist between two variables by exploring various methods.

Competency Level 20.2 : Illustrates the behavior of a variable pictorially.

Activity 20.2 : Let us represent inequalities on a number line.

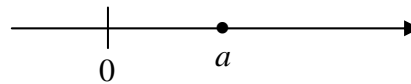
Time : 75 minutes.

Quality Inputs : • Four copies of the instruction leaflet on exploration included in Annex 20.2.1.
• Demy papers and pastels.

Learning – Teaching Process:

Step 20.2.1 : • Draw a number line on the blackboard.
• Direct the students to mark a decimal number and a fraction on the number line.
• Lead a discussion and highlight the following facts.

- That when representing a relationship of the form $x = a$ on a number line, the point a must be darkened



- That any point represented on a number line can be written in the form $x = a$
- That integers can be represented on a number line
- That 'x greater than a' is represented by $x > a$
- That 'x less than a' is represented by $x < a$

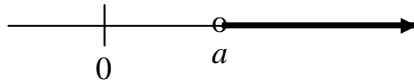
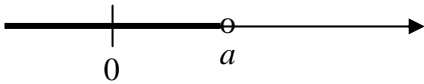
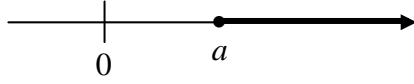
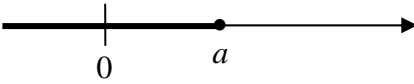
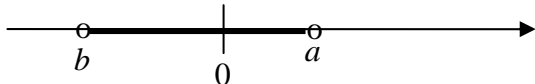
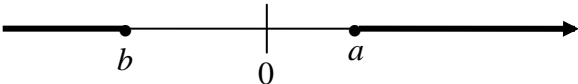
(15 minutes)

Step 20.2.2 : • Divide the class into four small groups.
• Distribute the instructions on exploration, demy papers and pastels among the groups.
• Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
• Engage the small groups in exploration.
• Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 20.2.3

- : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That inequalities can be represented on a number line
- That $x > a$ must be represented as follows

- That $x < a$ must be represented as follows

- That $x \geq a$ must be represented as follows

- That $x \leq a$ must be represented as follows

- That $b < x < a$ must be represented as follows

- That $x \leq b$ or $x \geq a$ must be represented as follows


(30 minutes)

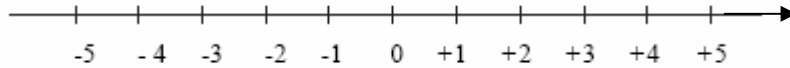
Criteria for Assessment and Evaluation:

- Represents the integers that are greater or equal to a given integer on a number line.
- Represents the values that are greater than or equal to, or less than or equal to a given value on a number line.
- Represents the values indicated by an inequality on a number line.
- Has an awareness of limits and boundaries when working according to a plan.
- Ensures the successful completion of a task by working critically.

Annex 20.2.1

Instructions for group exploration

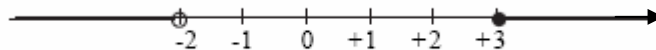
Let us represent inequalities on a number line



- Focus your attention on the set of numbers received by your group from the following sets of numbers.

| Group | Set of Numbers |
|-------|-------------------------------|
| 1 | 2.5, 3, 3.5, 4, 4.5, 6 |
| 2 | 0.5, -0.5, -1, -2, -1.5, -3.5 |
| 3 | 2, 3, 4.5, 4, 5.5, 6.5 |
| 4 | -1, -3, -0.5, 0, -2.5, -4.5 |

- Copy the given number line.
- Represent the numbers assigned to your group on the number line.
- Write down a relationship using $>$ or $<$, between all the numbers represented above and the number 1.
- Propose a suitable method to represent the values indicated by the above inequality on the number line.
- Represent $x > -2$ and $x \leq +3$ on two separate number lines.
- Represent the two inequalities on the same number line.
- Using $<$ and \leq , write down an inequality to represent the values obtained by representing both of the above inequalities on the same number line.



- Write down the inequalities represented on the above number line.
- Prepare for a presentation at the plenary session.

25. Number line and Cartesian plane - III

Competency 20 : Easily communicates the mutual relationships that exist between two variables by exploring various methods.

Competency Level 20.3 : Represents location on a Cartesian Plane.

Activity 20.3 : Let us draw graphs.

Time : 75 minutes.

Quality Inputs :

- The chart of figures included in Annex 20.3.1.
- Four copies of the instruction leaflet on exploration included in Annex 20.3.2.
- Demy papers and pastels.

Learning – Teaching Process:

Step 20.3.1

- Display the chart with the number line and the coordinate plane consisting of positive coordinates.
- Lead a discussion so that the following facts on the representation of numbers on a number line and on a positive coordinate plane are highlighted.

- That directed numbers can be represented on a number line
- That there is a specific place on a number line to represent $x = a$
- That the position of a point having a pair of positive coordinates can be marked on a coordinate plane
- That the first coordinate is named the **x coordinate** and the second coordinate is named the **y coordinate**
- That the plane formed by the x -axis and the y -axis is called the **coordinate plane (Cartesian plane)**

(15 minutes)

Step 20.3.2

- Divide the class into four small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the small groups prepare for a presentation at the plenary session.

(30 minutes)

Step 20.3.3

- : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That the set of points with x coordinate equal lie on the same straight line
- That the set of points with y coordinate equal lie on the same straight line
- That the set of points with x coordinate equal lie on a straight line parallel to the y – axis
- That the set of points with y coordinate equal lie on a straight line parallel to the x – axis
- That the straight line which passes through the set of points with x coordinate equal to a is denoted by $x = a$
- That the straight line which passes through the set of points with y coordinate equal to b is denoted by $y = b$

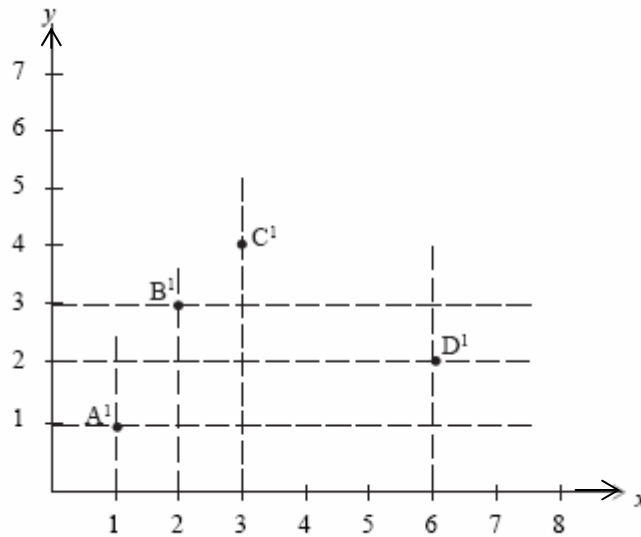
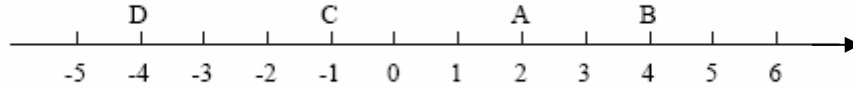
(30 minutes)

Criteria for Assessment and Evaluation:

- Expands the coordinate plane so that a pair of coordinates with negative values can be represented on it.
- Accurately writes down the equation of a line that passes through the points with x coordinate equal or with y coordinate equal.
- Writes down the points that lie on the line $x = a$ or the line $y = b$.
- Makes correct decisions by studying relationships.
- Develops methods suitable for the occasion and implements them.

Annex 20.3.1

Chart of Figures



Annex 20.3.2

Instructions for group exploration

Let us draw graphs

- Draw a Cartesian coordinate plane indicating 0 to +4, on the top right hand side of the graph paper.
- Can you mark negative coordinates on your coordinate plane? If not, propose a method to extend the coordinate plane so that negative coordinates could also be marked on it.
- Extend the coordinate plane as proposed by you.

- Now, focus your attention on the set of points received by you from the following sets of point.

| | |
|---|---|
| $(-3, 1), (-3, 2), (-3, 3),$ $(-3, 4), (-3, -1), (-3, -4)$ | $(3, 1), (3, 2), (3, 3),$ $(3, 4), (3, -1), (3, -4)$ |
| $(1, 1), (2, 1), (3, 1),$ $(4, 1), (-1, 1), (-4, 1)$ | $(1, -3), (2, -3), (3, -3),$ $(4, -3), (-1, -3), (-4, -3)$ |

- Mark the set of points you received on the coordinate plane that you prepared.
- By joining the above points together, determine whether they lie on a straight line.
- Write down the coordinates of three other points on the line.
- Determine the relationships that exist between your set of points and the straight line you drew and note them down.
- Based on the relationships you found, propose an equation (name) for the straight line you drew.
- Prepare for a presentation at the plenary session.

26. Loci and Constructions - I

- Competency 27** : Analyzes according to geometric laws, the nature of the locations in the surroundings.
- Competency Level 27.1** : Compares various movements with the basic loci.
- Activity 27.1** : Let us indicate the path of a point that moves according to a law.
- Time** : 75 minutes.
- Quality Inputs** :
- Circular shapes of different colours punched out from puncher, or lentil seeds.
 - Four copies of the instruction leaflet on exploration included in Annex 27.1.1.
 - Straight edges.
 - Gum.
 - Demy papers and pastels.
- Learning – Teaching Process:**
- Step 27.1.1** :
- Present cases such a fruit or a leaf falling from a tree, the point of the second hand in a clock, the valve in a rotating bicycle wheel, a stain at the edge of a blade of a rotating fan, a rotating fire ball, a child seated on a moving merry-go-round, ... and lead a discussion on their paths.
 - During the discussion highlight the following facts.

- That the paths of moving objects vary
 - That the movements of some objects are neither according to a law, nor due to an external influence
 - That the movements of some objects are according to a law
- (15 minutes)
- Step 27.1.2** :
- Divide the class into four small groups.
 - Distribute the instructions on exploration, straight edges, demy papers, pastels, gum and small circular shaped pieces of paper obtained using a puncher (a sufficient amount) among the groups.
 - Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
 - Engage the small groups in exploration.
 - Let the groups prepare for a presentation at the plenary session.
- (30 minutes)

Step 17.1.3

- :
- Provide each small group with the opportunity to present the findings of the group.
 - Give the presenters themselves the first opportunity to elaborate on the presentation.
 - Seek for constructive comments from the other groups.
 - Engage in a review so that the following facts are highlighted.

- | |
|---|
| <ul style="list-style-type: none"> • That the path of a point that moves at a constant distance from a fixed point is a circle • That the path of a point that moves at a constant distance from a fixed straight line is a straight line parallel to the fixed line • That the path of a point that moves at an equal distance from two intersecting straight lines is the bisector of the angle between the two intersecting lines • That the path of a point that moves at a equal distance from two fixed points is the perpendicular bisector of the line that joins the two fixed points • That the path of a point that moves according to a law is called a locus • That formal methods should be used to draw the locus of a point that moves according to a law accurately • That there are four basic loci |
|---|

(30 minutes)

Criteria for Assessment and Evaluation:




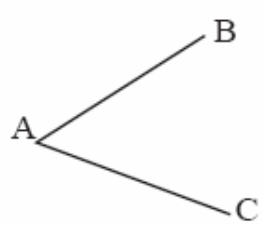
- Describes the path of a point that moves according to a law.
- Describes the path of a point in terms of loci.
- Illustrates the four basic loci by figures.
- Uses knowledge gained from experience appropriately.
- Is inclined towards making new creations.

Annex 27.1.1

Instructions for group exploration

Let us indicate the path of a point that moves according to a law

- Focus your attention on the case received by your group from the cases in the information table given below

| (1) | (2) | (3) | (4) |
|---|---|--|---|
|  |  |  |  |
| The path of a point that moves at a distance of 5 cm from the point P | The path of a point that moves at an equal distance from the two points P and Q | The path of a point that moves at a distance of 5 cm from the straight line AB | The path of a point that moves at an equal distance from the two straight lines AB and AC |

- Mark the point/points/straight line/straight lines received by your group on the given demy paper.
- Discuss about the indicated path and identify its properties.
- To describe the path based on the properties you identified, paste the material (small circular shapes) you were provided with on the demy paper.
- Find out about a method that can be used to draw the path you identified.
- Propose a suitable common name for the path.
- Prepare to present your findings creatively at the plenary session.

26. Loci and Constructions - II

- Competency 27** : Analyzes according to geometric laws, the nature of the locations in the surroundings.
- Competency Level 27.2** : Constructs triangles.
- Activity 27.2** : Let us construct triangles when the lengths of the sides are given.
- Time** : 60 minutes.
- Quality Inputs** :
- A loop formed by tying together the two ends of a 7m long piece of twine
 - Three copies of the instruction leaflet on exploration included in Annex 27.2.1.
 - A set of instruments for the teacher (large).
 - Demy papers, pastels, gum, ekels, 3 sets of instruments (normal).
- Learning – Teaching Process:**
- Step 27.2.1** :
- On the blackboard, draw a straight line segment of known length with the aid of the straight edge and a circle with the aid of the compass and discuss about drawing a straight line of given length, about the path of a point a constant distance from a fixed point being a circle, and that using these facts an equilateral triangle can be constructed.
 - Mark three points arbitrarily on the loop that was made, and with the assistance of three students, form a triangle with the three points as vertices, by requesting the students to stretch the twine and hold it at the three points. Inquire from the students whether a triangle can always be formed in this manner.
 - Lead a discussion and highlight the following facts.

- That a triangular shape has three vertices and three sides
 - That a straight line segment of known length can be drawn with the aid of a straight edge
 - That an equilateral triangle can be constructed with the aid of a straight edge and compass
 - That the locus of a point a constant distance from a fixed point is a circle
- (15 minutes)

Step 27.2.2

- : • Divide the class into three small groups.
- Distribute the instructions on exploration, ekels, demy papers, gum, pastels and sets of instruments among the groups.
- Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the small groups prepare for a presentation at the plenary session.

(25 minutes)

Step 27.2.3

- : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That if three measures of length are such that the least length + the medium length $>$ the greatest length, then there exists a triangle with sides of length the above three measures
- That triangles cannot be formed from sets of three measures of length that do not satisfy the condition 'the least length + the medium length $>$ the greatest length'
- That a triangle can be constructed using a straight edge and compass when the lengths of the three sides are known

(20 minutes)

Criteria for Assessment and Evaluation:

- When three measures of length are given, examines using physical objects, whether a triangle with sides of length the given measures exists.
- When three measures of length are given, uses the relationship 'the least length + the medium length $>$ the greatest length' to examine whether a triangle with sides of length the given measures exists.
- Constructs a triangle using a straight edge and compass when the lengths of the three sides are given.
- Comes to pre-determined conclusions based on theory.
- Completes tasks effectively by working as a team.

Annex 27.2.1

Instructions for group exploration

Let us construct triangles when the lengths of the sides are given

Sets of Measures of Length

| A | B | C |
|-------------------|-------------------|------------------|
| (4cm, 8cm, 6cm) | (5cm, 7cm, 10cm) | (8cm, 6cm, 10cm) |
| (5cm, 8cm, 13cm) | (5cm, 8cm, 15cm) | (6cm, 5cm, 14cm) |
| (8cm, 12cm, 10cm) | (7cm, 10cm, 15cm) | (12cm, 8cm, 7cm) |
| (8cm, 5cm, 14cm) | (7cm, 5cm, 12cm) | (10cm, 6cm, 4cm) |

- Focus your attention on the four sets of lengths received by your group.
- Break pieces of ekel that are of the lengths given in all four sets.
- Using the ekels of length the measures in one set, examine whether a triangle can be formed. (Note that the triangle should be formed so that the ends of the ekels meet to form the vertices)
- Examine all four sets in the above manner, select the sets with measures that can be used to form triangles, form triangles using the ekels with these lengths, and paste them on the demy paper.
- By considering the above process, propose a method to determine when three measures of length are given, whether a triangle exists with the given measures as the lengths of its sides.
- Propose three measures of length which are less than 12 cm each that are the lengths of the sides of a triangle.
- Using a straight edge and compass construct a triangle with sides of the length the measures you proposed above.
- Explain with the steps included, how the triangle was constructed.
- Prepare to present the findings of the group at the plenary session.

27. Representation of Data and Representative Values - I

- Competency 28** : Facilitates daily work by investigating the various methods of representing data.
- Competency Level 28.1** : Represents data such that comparison is facilitated.
- Activity 28.1** : Let us represent data in a pie chart. Let us tabulate data.
- Time** : 100 minutes.
- Quality Inputs** :
- Chart of figures included in Annex 28.1.1.
 - Four copies of the instruction leaflet on exploration included in Annex 28.1.2.
 - i. 25 pieces of straw of 5 different lengths which are integral values between 25 cm – 30 cm
 - ii. 25 pieces of straw of 5 different lengths which are integral values between 20 cm – 25 cm
 - iii. 25 pieces of straw of 5 different lengths which are integral values between 15 cm – 20 cm
 - iv. 25 pieces of straw of 5 different lengths which are integral values between 18 cm – 25 cm
 - Demy papers, instrument boxes, colours/pastels
- Learning – Teaching Process:**
- Step 28.1.1** :
- Present the chart of figures to the class and lead a discussion on raw data, on how data is represented in column graphs and stem and leaf diagrams, on sectors of a circle and on the sum of the angles around a point.
 - During the discussion, highlight the following facts.

- That data relevant to a piece of information can be represented in various forms
 - That communication is facilitated by using column graphs instead of the raw data
 - That a part of a unit could be expressed as a fraction
 - That the sum of the angles around a point is 360°
 - That a circle can be divided into sectors.
 - That a sector of a circle has an angle at the centre
- (10 minutes)
- Step 28.1.2** :
- Divide the class into four small groups.
 - Distribute the instructions on exploration, instrument boxes, demy papers and colours/pastels among the groups.
 - Focus the attention of the groups on part I of the instructions on exploration and assign the relevant task to each group.

- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(25 minutes)

Step 28.1.3

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That data can be represented by dividing a circle into sectors
- That such representations are called pie charts
- That when drawing pie charts the angle corresponding to each of the data has to be calculated
- That the relevant information is represented by sectors
- That only a limited number of data can be conveniently represented by a pie chart
- That pie charts can be used to represent data attractively
- That pie charts have the convenience of enabling instant comprehension of data
- That even a person with little understanding of numbers can compare the data in a pie chart and indicate whether there is more or less of one type of data compared to another

(30 minutes)

Step 28.1.4

- Organize the groups again.
- Distribute the sets of straws among the groups.
- Focus the attention of the groups on part II of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(20 minutes)

Step 28.1.5

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.

- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That a group of raw data can be represented in a table
- That it is more appropriate to use a table to represent a group of data when the same score appears repeatedly
- That when data has been tabulated, the number of times a score is repeated can be easily obtained
- That the number of times a score is repeated is its frequency (f)
- That such a table is called a frequency table
- That it easier to come to various conclusions regarding a group of data when it is tabulated

(15 minutes)

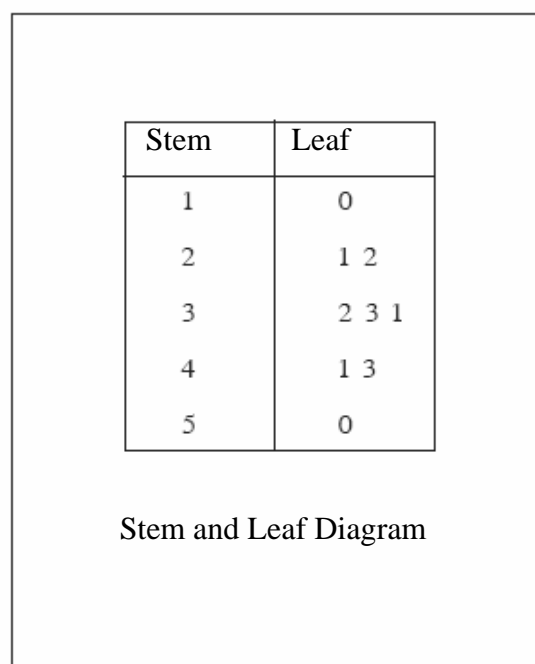
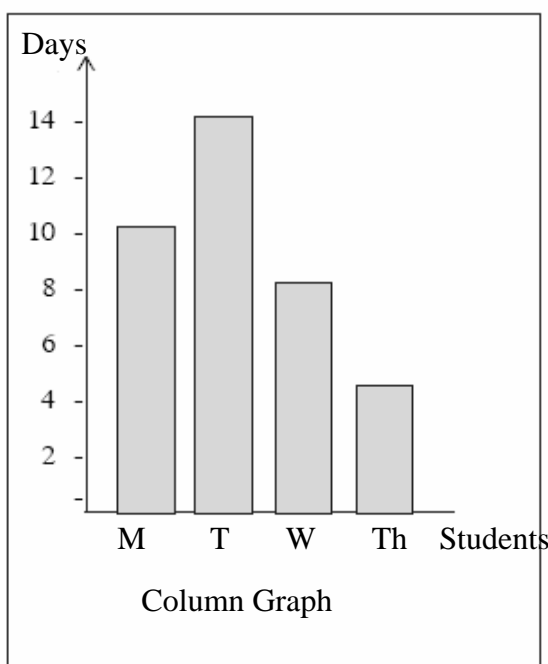
Criteria for Assessment and Evaluation:

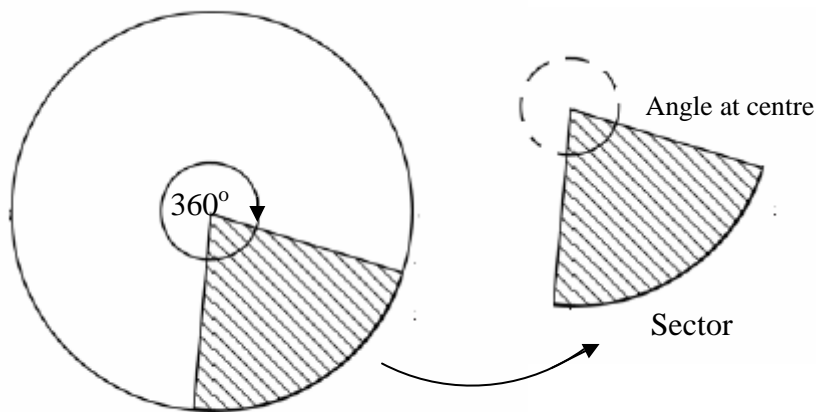
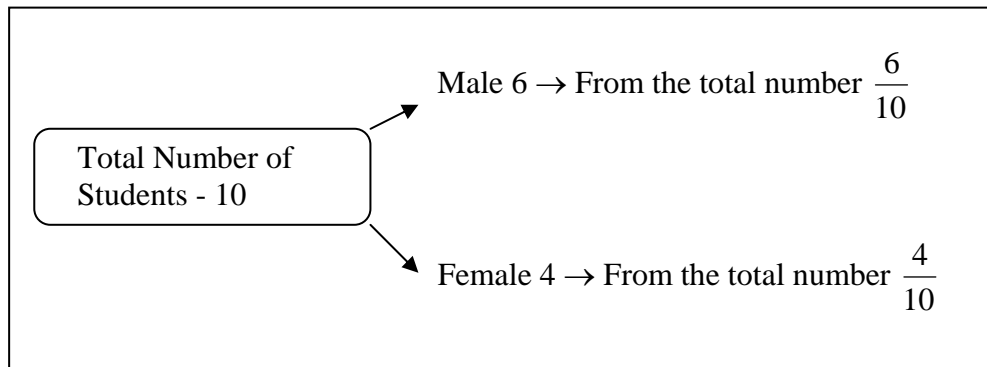
- Represents a group of data in a pie chart.
- Tabulates a group of data meaningfully.
- Easily interprets data by representing it using various methods.
- Develops new concepts based on previous experience.
- Uses various methods to facilitate communication.

Annex 28.1.1

Chart of Figures

- The heights of seven students are 1.2 m, 1.3 m, 1.4 m, 1.3 m, 1.3 m, 1.2 m, 1.3 m





Annex 28.1.2.

Instructions for group exploration

Let us represent data in a pie chart. Let us tabulate data

Part I

- The information obtained from students in four grade 8 classes of a certain school regarding their method of traveling to school is given below.

| Group | Grade | Method of Traveling to School | | | | Total Number of Students |
|-------|-------|-------------------------------|--------|------------|----------------|--------------------------|
| | | Walking | By Bus | By Bicycle | In a Priv. Van | |
| I | 8A | 20 | 14 | 4 | 2 | 40 |
| II | 8B | 18 | 9 | 6 | 3 | 36 |
| III | 8C | 18 | 15 | 9 | 3 | 45 |
| IV | 8D | 12 | 8 | 4 | 6 | 30 |

- Focus your attention on the data assigned to your group.
- Find out what fraction of students from the total travel by each method and discuss how the fractions could be represented in a circle.

- Find a method that can be used to represent the fractions in a circle, such that the portions are divided from the centre.
- Represent the data in a circle and propose a name for the representation.
- Present facts on the importance and usefulness of representing data in this form.
- Prepare to present your findings at the plenary session.

Part II

- Focus your attention on the lengths of the straws in the set received by your group from the following sets of straws.
 - I. Set of straws – 01
 - II. Set of straws – 02
 - III. Set of straws – 03
 - IV. Set of straws - 04
- Measure the lengths of the straws in the set assigned to your group, note the data down, and investigate it.
- Separate out the straws into groups based on the lengths of the straws, such that each group contains all the straws of one length, and count the number of straws in each group.
- Prepare a table which is simple and easy to understand that includes the information on the length of the straws in the different groups.
- By studying the textbook, propose the names that are used in Statistics for such a table and for the columns of the table.
- List out the advantages and disadvantages of including data in the table you constructed.
- Prepare to present your findings at the plenary session

27. Representation of Data and Representative Values - II

Competency 29 : Makes predictions by analyzing data by various methods to facilitate daily activities.

Competency Level 29.1 : Inquires into numerical representative values of a group of data.

Activity 29.1 : Let us determine representative values using a numerical distribution.

Time : 120 minutes.

Quality Inputs :

- Chart of data included in Annex 29.1.1.
- Three copies of the instruction leaflet on exploration included in Annex 29.1.2.
- Demy papers and pastels.

Learning – Teaching Process:

Step 29.1.1 :

- Present the chart of data to the class.
- Lead a discussion and highlight the following facts.

- That stem and leaf diagrams are used to represent data
- That writing the values in the leaf section of a stem and leaf diagram in ascending order facilitates the analysis of data
- That a frequency distribution can be used to represent data
- That the range is the difference between the greatest and least values

(10 minutes)

Step 29.1.2 :

- Divide the class into three small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on part I of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(20 minutes)

Step 29.1.3

- : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That in a set of ungrouped data the value that occurs the most number of times is the mode
- That when ungrouped data is arranged in ascending or descending order, the value at the centre is called the median
- That the mean of a set of ungrouped data is the value that is obtained when all the data in the set is added together and divided by the number of data in the set
- That the mode, median and mean are the representative values of a numerical distribution

(30 minutes)

Step 29.1.4

- : • Organize the groups again.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on part II of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 29.1.5

- : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That representative values such as the mode, median and mean can also be determined using a frequency distribution that is prepared in the case when the scores of the set of ungrouped are repeated

- That if the total number of data in a frequency distribution is an even number, since there are two middle values, the median of the distribution is obtained by taking the mid-value of the middle two scores when the scores have been placed in ascending or descending order
 - That in a frequency distribution, by multiplying a score (n) by its frequency (f) and summing up, the total sum of the scores can be obtained ($\sum fn$)
 - That the mean can be obtained by dividing the total sum of the scores by the total sum of the frequencies
 - That this can be represented by the formula
- $$\text{mean} = \frac{\sum fn}{\sum f}$$

(30 minutes)

Criteria for Assessment and Evaluation:

- Describes the range, mode, median and mean of a numerical distribution.
- Determines the mode, median and mean of a group of numbers.
- Calculates the representative values of a numerical distribution.
- Manipulates representative values for one's needs.
- Comes to common conclusions by considering the opinions of others also.

Annex 29.1.1

Chart of Data

- The marks obtained by 11 students for the number of correct answers they got for a multiple choice paper consisting of 40 questions is given below.

3, 8, 3, 8, 16, 14, 14, 14, 25, 25, 31

| Stem | Leaf |
|------|---------|
| 0 | 3 8 3 8 |
| 1 | 6 4 4 4 |
| 2 | 5 5 |
| 3 | 1 |

| Stem | Leaf |
|------|---------|
| 0 | 3 3 8 8 |
| 1 | 4 4 4 6 |
| 2 | 5 5 |
| 3 | 1 |

| Marks | Frequency |
|-------|-----------|
| 3 | 2 |
| 8 | 2 |
| 14 | 3 |
| 16 | 1 |
| 25 | 2 |
| 31 | 1 |

Annex 29.1.2.

Instructions for group exploration

Let us determine representative values using a numerical distribution

Part I

- Focus your attention on the following numerical distribution and the information received by you
- **Numerical Distribution**

The marks obtained by 9 students who provided answers to 12 questions is given below

1, 2, 3, 3, 4, 5, 7, 8, 12

- **Information**

| I | II | III |
|--|--|--|
| 3 is a special value in the above distribution | 4 is a special value in the above distribution | 5 is a special value in the above distribution |

- Study the numerical distribution carefully.
- Determine the range within which the values of the distribution lie.
- Examine whether there is a connection between the special value that your group received and the distribution.
- Discover the relationship between the special value and the numerical distribution
- Propose a suitable name for the special value by studying the text book.
- By applying what you discovered above, determine the special value of the type you received for the following numerical distribution also

5, 8, 7, 2, 2, 9, 2

- Prepare to present your findings creatively at the plenary session.

Part II

- The marks obtained out of 10 for three subjects by a group of grade 8 students who sat an examination are given below. From the sets of marks, focus your attention on the set of marks received by your group.
 1. Marks obtained for Mathematics:
2, 3, 4, 5, 6, 6, 7, 8, 4, 6, 7, 8, 8, 5, 6, 7, 8, 6, 7, 8, 9, 6, 7, 8, 8, 10, 6, 8, 9, 8
 2. Marks obtained for Science:
2, 3, 4, 5, 6, 7, 8, 4, 9, 5, 6, 8, 6, 7, 5, 9, 6, 7, 7, 8, 9, 5, 8, 10, 8, 10, 8, 9, 8, 8
 3. Marks obtained for English:
2, 3, 4, 5, 6, 7, 8, 4, 5, 6, 7, 8, 5, 6, 7, 8, 6, 7, 8, 6, 7, 8, 10, 7, 7, 8, 8, 10, 8, 9
- Study the group of marks carefully and determine the total number of students who faced the examination.
- By using tally marks, represent the group of marks in a frequency table.
- Discuss within the group how the mode and the median of the marks the students obtained could be found.
- Discover how the table should be extended by adding another column and completed, so that the total marks obtained by the students in the class could be easily determined.
- Thereby find the total sum of the marks obtained by all the students.
- Discuss within the group the method of finding the mean mark obtained by a student and determine it.
- By considering the values you obtained, note down your ideas and the conclusions that you can come to regarding the students' subject knowledge.
- Prepare to present your findings creatively at the plenary session.

28. Scale Drawings

Competency 13 : Uses scale drawings in practical situations by exploring various methods.

Competency Level 13.2 : Describes various locations in the environment using scale drawings.

Activity 13.2 : Let us explain scale drawings.

Time : 60 minutes.

Quality Inputs : • Three copies of the instruction leaflet on exploration included in Annex 13.2.1.
• Demy papers, three straight edges and pastels

Learning – Teaching Process:

Step 13.2.1 : • In the classroom, display posters that include scale drawings of items such as a sports ground, a piece of land divided into several plots to be sold, a house and a plant/animal cell and lead a discussion on scale drawings.
• During the discussion highlight the following facts.

- That a suitable scale should be selected when making a scale drawing
- That a scale is represented in the form $1\text{ cm} \rightarrow y\text{ m}$ or $1\text{ cm} \rightarrow x\text{ cm}$ or $1 : x$
- That scale drawings are used to enlarge figures as well as to draw them smaller

(10 minutes)

Step 13.2.2 : • Divide the class into three small groups.
• Distribute the instructions on exploration, straight edges, demy papers and pastels among the groups.
• Focus the attention of the groups on the instructions on exploration and assign the relevant task to each group.
• Engage the small groups in exploration.
• Let the groups prepare for a presentation at the plenary session.

(20 minutes)

Step 13.2.3 : • Provide each small group with the opportunity to present the findings of the group.
• Give the presenters themselves the first opportunity to elaborate on the presentation.
• Seek for constructive comments from the other groups.

- Engage in a review so that the following facts are highlighted.

- That a scale represented in the form $1\text{ cm} \rightarrow x\text{ m}$ can also be represented in the form $1 : a$
- That if the area of a scale drawing of scale $1 : x$ is a , then the area of the actual figure is given by $A = ax^2$
- That the length of the sides of the actual figure can be obtained by multiplying the length of the sides of the scale drawing by the scale factor

(30 minutes)

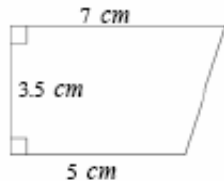
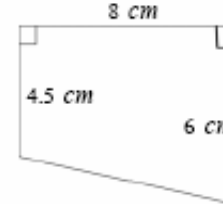
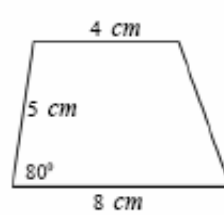
Criteria for Assessment and Evaluation:

- Calculates the length in a scale drawing when the actual length and the scale are given.
- Makes a scale drawing when the measures of the actual figure and the scale are given.
- Calculates the measures of the actual figure using the scale drawing.
- Uses various representative methods to facilitate communication.
- Patently examines the opinions of others.

Annex 13.2.1

Instructions for group exploration

Let us explain scale drawings

| | 1 | 2 | 3 |
|---|---|---|---|
| A | A rectangular piece of land of length 700m and breadth 300m | A rectangular piece of land of length 450m and breadth 250m | A rectangular piece of land of length 550m and breadth 300m |
| B |  <p style="text-align: center;">$1\text{ cm} \rightarrow 100\text{ cm}$</p> |  <p style="text-align: center;">$1\text{ cm} \rightarrow 200\text{ cm}$</p> |  <p style="text-align: center;">$1\text{ cm} \rightarrow 50\text{ cm}$</p> |

- Focus your attention on the measurements of the plot of land in section A of the case received by your group from the cases given above.
- Sketch a figure of the land with the measurements included in it, and calculate the area of the land.
- Propose a suitable scale to make a scale drawing of the land and write the scale down as a ratio.
- Make a scale drawing of the land based on the proposed scale.
- Calculate the area of the scale drawing.
- Discuss how the area of the land could be obtained from the area of the scale drawing, and determine the area of the land using this method too.
- Focus your attention on part B of the case you received, which contains a chart prepared to make a scale drawing of a land.
- Make this scale drawing.
- Discuss how the actual length of the boundaries of the land in part B could be found using the scale drawing, and find it.
- Prepare to present your findings creatively at the plenary session.

29. Inequalities

Competency 18 : Analyzes the relationships between various quantities related to real-life problems.

Competency Level 18.1 : Uses the relationships between two quantities to solve problems.

Activity 18.1 : Let us solve inequalities.

Time : 135 minutes.

Quality Inputs :

- Four copies of the instruction leaflet on exploration included in Annex 18.1.1.
- Demy papers and pastels

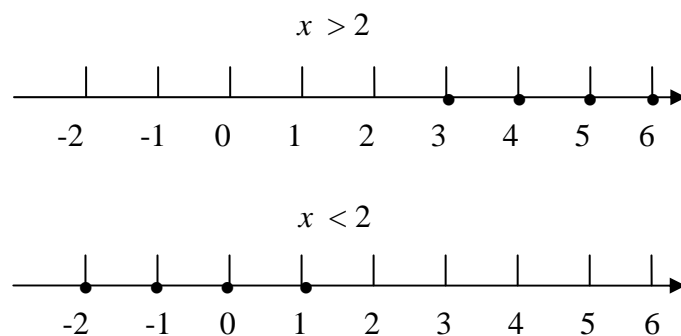
Learning – Teaching Process:

Step 18.1.1

- Write an inequality on the blackboard, and discuss with the students how the inequality is constructed and how it is solved.

• During the discussion highlight the following facts.

- That an inequality is a relationship that is developed based on given information using an algebraic symbol and the symbols “ $<$, $>$ ”
- That some inequalities can be solved using the basic axioms that are used to solve equations
- That the integral solution set of an inequality can be represented on a number line as follows



(15 minutes)

Step 18.1.2

- Divide the class into four small groups.
- Distribute the instructions on exploration, demy papers and pastels among the groups.
- Focus the attention of the groups on part I of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 18.1.3

- : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That the relationship ' $x + 1 > 4$ or $x + 1 = 4$ ' can be compounded and written as $x + 1 \geq 4$
- That the relationship ' $x + 1 < 4$ or $x + 1 = 4$ ' can be compounded and written as $x + 1 \leq 4$
- That all the solutions of an inequality of the form $x + 1 \leq 4$ can be determined
- That all the solutions of an inequality of the form $x + 1 \leq 4$ can be represented on a number line as follows

(30 minutes)

Step 18.1.4

- : • Organize the groups again.
- Focus the attention of the groups on part II of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(30 minutes)

Step 18.1.5

- : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That when an inequality is multiplied or divided by a negative number the inequality changes to the opposite inequality
- That $2x - 1 \leq -1$ can be written as $-2x + 1 \geq 1$

(30 minutes)

Criteria for Assessment and Evaluation:

- Represents an inequality of the form $x \leq 2$ on a number line.
- Pictorially represents the solutions of an inequality of the form $x + 1 \geq 4$.
- Determines the solutions of any inequality.
- Is inclined to find successful solutions obeying given conditions.
- Uses simple methods to communicate.

Annex 18.1.1**Instructions for group exploration****Let us solve inequalities****Part I**

- Focus your attention on the pair of relationships assigned to your group from the pairs of relationships given below.
 - (i) $x + 1 > 4$, $x + 1 = 4$
 - (ii) $x + 1 < 4$, $x + 1 = 4$
 - (iii) $x - 1 > 4$, $x - 1 = 4$
 - (iv) $x - 1 < 4$, $x - 1 = 4$
- Find out about the integral solutions between -10 and 10 of the relationships assigned to you.
- Based on the above solutions, develop a single inequality by compounding the pair of relationships.
- Find out whether there are other solutions apart from the integral solutions.
- Draw a number line and discuss within the group the method of representing all the solutions of the inequality you obtained by combining the relationships together.
- Represent the solutions on the number line.
- Prepare to present your findings at the plenary session.

Part II

- Focus your attention on the inequality assigned to your group from the inequalities given below.
 - (i) $-3x > 6$
 - (ii) $-3x < 6$
 - (iii) $-3x > -6$
 - (iv) $-3x < -6$
- Solve the inequality using familiar methods and obtain four suitable solutions.
- Change the inequality sign in the inequality you obtained as a solution to the opposite sign, and find four solutions to this inequality.
- Re-examine whether the solutions you obtained in the above two instances satisfy the inequality you received.
- Based on it, discover what happens to an inequality sign when an inequality is divided by a negative number.
- Write down an algebraic inequality such that the coefficient of the unknown is negative, and determine its solution based on your discovery.
- Discuss how -1 is associated with the solving of an inequality.
- Prepare to present your findings at the plenary session.

30. Probability

- Competency 31** : Analyzes the likelihood of an event occurring to predict future events.
- Competency Level 31.1** : Determines the likelihood of an event occurring by investigating the various methods of finding a suitable value.
- Activity 31.1** : Let us determine a more suitable definite value for the likelihood of an event.
- Time** : 115 minutes.
- Quality Inputs** :
- Three cubic die with the following values marked on the six sides
 - (i) 1, 2, 3, 4, 5, 6
 - (ii) 1, 1, 2, 2, 3, 3
 - (iii) 1, 1, 1, 2, 2, 2
 - Four copies of the instruction leaflet on exploration included in Annex 31.1.1.
 - Five equal sized balls which are red, blue, green, black and white in colour
 - A coin
 - Sets of cards with the numbers relevant to the events mentioned in the leaflet on exploration included in them
 - Demy papers and pastels
- Learning – Teaching Process:**
- Step 31.1.1** :
- Present the three cubic die to the class and get three students to toss each dice up once.
 - Discuss about the likelihood of obtaining a 3 on a dice.
 - During the discussion highlight the following facts.

- That in an experiment in which all outcomes have an equal likelihood of occurrence, the object used is called **unbiased**
 - That in an experiment in which all the outcomes do not have an equal likelihood of occurrence, the object used is called **biased**
 - That the likelihood of outcomes from an unbiased object are equal
- (15 minutes)
- Step 31.1.2** :
- Divide the class into four small groups.
 - Distribute the instructions on exploration, demy papers, pastels and other required material among the groups.

- Focus the attention of the groups on part I of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare creatively for presentations at the plenary session. (30 minutes)

Step 31.1.3

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That experiments can be used to determine the likelihood of an event occurring
- That the fraction of success is determined using the number of successes obtained in an experiment
- That the **fraction of success** is obtained by dividing the number of successes by the number of times the experiment was carried out
- That when the number of times the experiment is carried out is increased, the fraction of success obtained will be more suitable for the likelihood of the relevant event
- That the fraction of success obtained by carrying out an experiment many times over is called the **experimental probability**

(30 minutes)

Step 31.1.4

- Organize the groups again.
- Focus the attention of the groups on part II of the instructions on exploration and assign the relevant task to each group.
- Engage the small groups in exploration.
- Let the groups prepare for a presentation at the plenary session.

(20 minutes)

Step 31.1.5

- Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.

- Engage in a review so that the following facts are highlighted.

- That the likelihood of an event occurring can be determined without carrying out experiments by considering the equal likelihood of outcomes
- That the probability determined using the equal likelihood of outcomes, without carrying out experiments, is called the **theoretical probability**
- That the theoretical probability is obtained by dividing the number of required outcomes by the total number of outcomes that could occur
- That the theoretical probability is a more suitable value than the experimental probability for the likelihood (probability) of an event

(20 minutes)

Criteria for Assessment and Evaluation:

- Calculates the fraction of success of an event occurring based on the results of an experiment in which the likelihood of outcomes is equal.
- Expresses the experimental probability of an event using the fraction of success.
- Determines the probability of a simple event using the theoretical probability.
- Makes predictions for the future based on events.
- Is inclined to search for connections with the subject in normal events .

Annex 31.1.1**Instructions for group exploration****Let us determine a more suitable definite value for the likelihood of an event****Part I****Event 1**

Getting the card with 1 marked on it when a card is picked without selection from a set of 6 cards of equal size with 1, 2, 3, 4, 5 and 6 marked on them.

Event 2

Getting the red coloured ball when a ball is picked without selection from a bag which contains four equal sized balls which are red, blue, green and black in colour.

Event 3

Getting the side with number 6 on it when a cubic dice with 1, 2, 3, 4, 5 and 6 marked on the six sides is tossed once.

Event 4

Getting the card with 0 marked on it when a card is picked without selection from a set of 10 cards of equal size with 0, 1, 2,9 marked on them.

- Focus your attention on the event received by your group.
- Carryout the experiment relevant to the event in the same manner repeatedly, and enter the number of times the experiment is carried out as well as the number of successful outcomes in the following table.

| | | | | | |
|---|----|----|----|----|----|
| Number of times the experiment was carried out | 10 | 20 | 30 | 40 | 50 |
| The number of successful outcomes relevant to the event | | | | | |
| The successful outcomes as a fraction of the total number of outcomes | | | | | |

- Express the successful outcomes as a fraction of the total number of times the experiment was carried out.
- Propose a suitable name for the fraction you obtained above
- Determine which of the fractions you obtained above is the most suitable value for the likelihood of the event
- Give reasons for your selection.
- If likelihood is named as **probability**, propose a suitable name for the likelihood you obtained above which was based on the results of the experiment you carried out.
- Prepare to present your findings at the plenary session.

Part II

- Focus your attention on the event assigned to your group from the events given below.
 - Obtaining a Head by tossing an unbiased coin up.
 - Obtaining a 6 when a cubic dice with 1 to 6 marked on it is tossed up.
 - Picking the red ball without looking, from a bag containing 5 equal sized glass balls that are red, blue, green, black and white in colour.
 - Getting the card with 5 marked on it when a card is picked without selection from a set of 10 cards of equal size with 1 to 10 marked on them.
- List out all the possible outcomes of the experiment relevant to your event.
- Determine whether the likelihood of each of the outcomes is equal.
- Based on it, determine the likelihood of the desired event by considering the event in relation to the total possible outcomes
- Propose a suitable name for the likelihood (probability) of a desired event, obtained without carrying out an experiment.
- Discuss within the group whether this probability is suitable to indicate the likelihood of an event occurring.
- Prepare to present your findings at the plenary session.

31. Tessellation

- Competency 26** : Investigates the methods of organizing various geometrical shapes and uses them to enhance beauty.
- Competency Level 26.1** : Studies shapes by creating various patterns that can be used to enhance beauty.
- Activity 26.1** : Let us create designs by using shapes.
- Time** : 70 minutes.
- Quality Inputs** :
- An enlarged copy of the picture chart included in Annex 26.1.1.
 - Three copies of the instruction leaflet on exploration included in Annex 26.1.2.
 - Various coloured demy paper, 3 Bristol boards, gum, pairs of scissors and one copy each of the polygons included in the instruction leaflet on exploration, cut out from cardboard
- Learning – Teaching Process:**
- Step 26.1.1** :
- Show the picture chart or the actual objects that appear in the chart to the students and inquire from them about the shapes in the objects and about their positions.
 - Lead a discussion and highlight the following facts.

- That covering a flat area completely with polygonal shapes such that there are no gaps between the shapes and such that the shapes do not overlap is called **tessellation**
 - That a tessellation using only one shape is called a **pure tessellation**
 - That tessellation plays an important role in enhancing beauty
- (10 minutes)
- Step 26.1.2** :
- Divide the class into three small groups.
 - Distribute the instructions on exploration, demy papers in two colours, pairs of scissors, gum and 1 Bristol board each among the groups.
 - Focus the attention of the groups on the instructions on exploration, assign the relevant task to each group and provide the nets of the relevant polygons.
 - Engage the small groups in exploration.
 - Let the groups prepare for a presentation at the plenary session.
- (45 minutes)

Step 26.1.3

- : • Provide each small group with the opportunity to present the findings of the group.
- Give the presenters themselves the first opportunity to elaborate on the presentation.
- Seek for constructive comments from the other groups.
- Engage in a review so that the following facts are highlighted.

- That tessellations done with two or more shapes are called **semi-pure tessellations**
- That when two shapes are being used in a tessellation, if the lengths of the sides of the shapes are multiples of the least length, the tessellation is made easier
- That when two shapes are being used in a tessellation, by changing the positions of the shapes and hence the patterns, various creations can be done
- That a tessellation done with 2 shapes is more attractive than a tessellation done with just one shape
- That tessellations have an important place in enhancing beauty

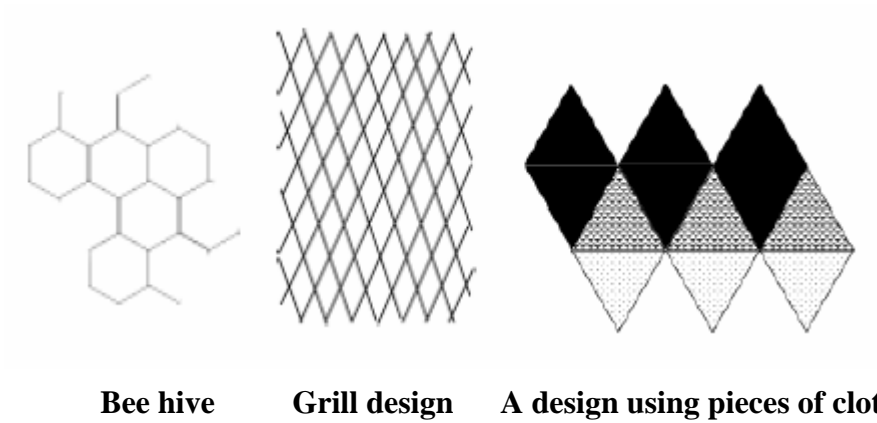
(15 minutes)

Criteria for Assessment and Evaluation:

- Creates a semi-pure tessellation design using a given equilateral triangle and square.
- Creates a semi-pure tessellation design when a triangle and two quadrilateral shapes have been given, by using them in various colours.
- Finds out about different tessellation designs that can be created using two shapes, and creates them.
- Gets used to using tessellation designs to enhance the beauty of the environment.
- Completes one's tasks with team spirit.

Annex 26.1.1

Picture Chart



Annex 26.1.2

Instructions for group exploration

Let us create designs by using shapes

| A | B | C |
|---|---|---|
| | | |

- Focus your attention on the set of shapes assigned to your group.
- Make as many copies of the shapes in the set assigned to you on the two coloured papers, and cut them out.

- Create a tessellation design using both types of shapes that you cut out and paste it on the Bristol board.
- Propose a name for your creation by studying the textbook.
- Examine whether other designs can be created using the same shapes as before by organizing them in a different way.
- If other designs were discovered during the above examination, make a sketch of them.
- Discuss within the group whether a pure tessellation or a tessellation using two shapes is more suitable for creative designs.
- Find out the types of relationships it is important to have between the sides of the two shapes, in tessellations such as the ones above.
- Prepare to present your findings creatively at the plenary session.

Assessment and Evaluation

Introduction

In the transformation role, a role which enters at the door of the new millennium, the main goal of the teacher is to present the country with citizens who will be able to face future challenges successfully. To enable you to carry out this teaching role successfully, a student centered, competency based, activity oriented curriculum has been presented to you.

An attempt has been made in this curriculum which is implemented through a pre-determined activity continuum, to integrate assessment and evaluation with learning and teaching. The teacher is provided with the opportunity to assess the students when they are involved in exploration within groups under the second step of each activity, and then to evaluate them when they present their findings and subject the same to elaboration. Under assessment, the teacher is expected to move among the students engaged in exploration, closely observe the tasks they are involved in, help them to solve in the classroom itself any problems they happen to encounter by providing them with facilities and guidance, and take steps to ensure that every student approaches the closest level of proficiency. In addition, under evaluation, the level of proficiency that the students approach through exploration should be determined and expressed.

The two way guidance that a teacher who is involved in assessment could give to his/her students is defined as feedback and feed forward. It is the task of the teacher to provide students with feedback to overcome their learning difficulties, when the weaknesses and inabilities of the students are discovered, and to provide feed forward when the abilities and strengths are identified, to further develop these capabilities. For the continuous development of student learning, it is as important to identify and inform students of the extent to which they have been able to actualize the competency levels included in the syllabus. It is expected that through the assessment programme, the teacher will determine the proficiency level that the students have approached, and communicate their progress to the students themselves, their parents and other relevant parties.

Five common criteria are proposed to facilitate the task of assessment and evaluation. Of these criteria, the first three which are based on the subject content relevant to the competency level, are subject skills organized in order of difficulty. The final two criteria which should be developed through the learning teaching process, are two common skills which are important in the learning of any subject. The teacher should make an effort to identify the five behavioral changes related to these criteria within the classroom itself while the students are active, strengthen them under assessment, and under evaluation, make judgments and inform the students regarding their level of achievement.

This section includes learning-teaching-evaluation instruments to further improve the programme of assessment and evaluation at the school level. The first task that should be carried out is to meaningfully group the activities included in the activity continuum. Many learning-teaching-evaluation forms that can enhance student learning have been selected, based on the subject content related to the group of activities. The teacher should come forward to teach students through these forms, taking teaching and student learning outside the time table and confirming student learning through regular monitoring. It is expected that the teacher will

introduce each instrument before the commencement of the first activity in the activity group and carry out regular assessments throughout the period that the activities in the activity group are being done. Once all the activities in the activity group are completed, the students should be provided with the opportunity to present their findings and to elaborate on them on a predetermined date. The elaborations should be done as in the case of the activities, first by the group which presents the findings, then by the other groups and finally by the teacher. In instances of explanation and elaboration, during the final review, the teacher should clarify all doubts, correct any wrong ideas, cover all the factual shortcomings in the presentations, highlight the subject content on which the learning outcomes are based and express the results of the evaluation. The teacher should understand that he/she should not postpone the task of evaluation to the end, but should use the time that students engage in explanations and elaborations to carry out evaluations. When the learning-teaching-evaluation instrument is being introduced the transaction role of the teacher comes into play while at the end of the learning-teaching-assessment-evaluation process, the teacher is required to do the final elaboration under the transmission role.

The third part of the Teacher's Instructional Manual has been prepared to introduce the number of evaluations that should be carried out during the activity continuum, the learning-teaching-evaluation instruments selected to carryout each of the evaluations successfully and the types of questions that could be included in the term tests and final test under an authentic evaluation scheme. All these modernizations pave the way for teachers to further enhance the learning teaching process by augmenting the learning-teaching-assessment-evaluation process with examination questions that are based on real life situations and by carrying out assessment and evaluation at appropriate points during the activities and the groups of activities and, for students to engage in learning with interest and understanding.

Learning-Teaching-Evaluation Instruments (Instruments for the extension of the learning – teaching process)

Instrument - 01

1. **Time of evaluation** : 1st term
2. **The competency levels covered** : 21.2, 22.1
3. **Relevant subject content** :
 - Calculating the size of an angle
 - Angles on a straight line
 - Angles around a point
 - Model of a solid
 - Octahedron
 - Dodecahedron
 - Verification of Euler's Relationship
 - For solids with only straight edges such as
 - Octahedron
 - Dodecahedron
 - Icosahedron
4. **Nature of the instrument** :
 - Exhibits
5. **Aims of the instrument** :
 - Creates ornaments by applying the knowledge on solids and angles.
 - Investigates the shapes of the faces and the angles of a solid.
 - Makes high quality creations using one's talent.
6. **Instructions to implement the instrument:**
 - For the teacher** :
 - Introduce this instrument to the class and inform them about the criteria for the allocation of marks before starting activity 21.2.
 - In a suitable manner, divide the class into four groups.
 - Provide the groups with the relevant net from the nets in the Annex, together with the instructions.
 - Provide the groups with sufficient Bristol boards, gum and half sheets.
 - Inform the students about the date the creations have to be handed over.
 - Evaluate the work based on the given criteria.

For the students

- Make the solid assigned to your group.
- Copy each of the faces of the solid on a half sheet, measure all the interior angles, and determine the sum of all the interior angles.
- Determine also, the sum of all the angles at a vertex of the solid.
- Using the given net also, make the relevant solids and form the compound solid (Create an ornamental solid using colours and other creative methods).
- Prepare a list of all its special features.
- On the assigned date, handover the creation to be displayed.
(Have sufficient pasting allowances in the nets)

Criteria of allocating marks:

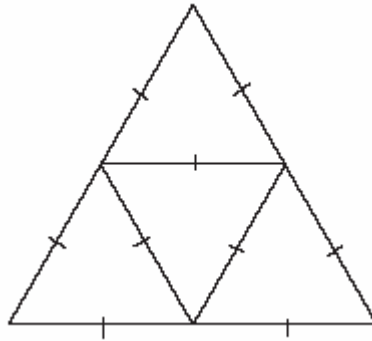
- Prepares the regular solid.
- Obtains the shape of a face, the sum of the interior angles of a face, and the sum of the angles at a vertex of the regular solid.
- Prepares the compound solid according to the given instructions.
- Works creatively and with minimum cost when making the creation attractive.
- Works as a team to complete the creation during the allocated time.

Marks range

| | |
|----------------|----|
| : Very Good | 04 |
| Good | 03 |
| Average | 02 |
| Should Improve | 01 |

Annex

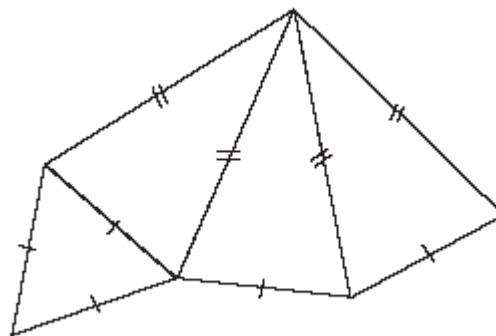
Instructions for Group 1



- Construct a regular tetrahedron with edges of length 10 cm each.
- Construct 4 regular tetrahedrons with edges of length 5cm each.
- Paste the smaller tetrahedrons on the 4 sides of the larger tetrahedron.

Annex

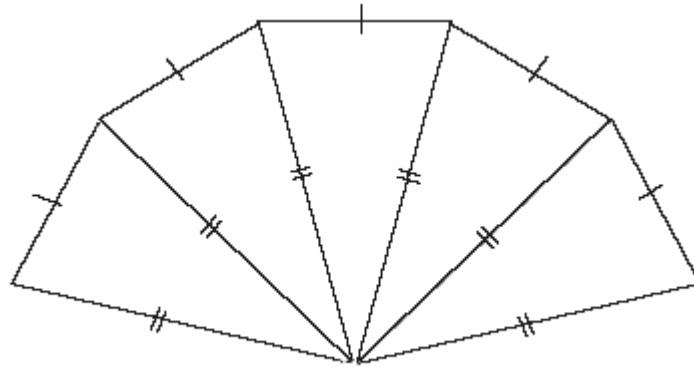
Instructions for Group 2



- Construct a regular octahedron with edges of length 5 cm each.
- Construct 8 triangular based pyramids using the given net.
- Paste the constructed pyramids on the faces of the octahedron.

Annex

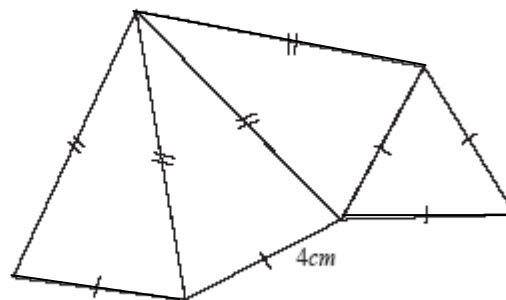
Instructions for group 3



- Construct a regular dodecahedron with edges of length 5 cm each.
- Using the given net, construct 12 pentagon based pyramids.
- Paste the 12 constructed pyramids on the faces of the dodecahedron.

Annex

Instructions for group 4



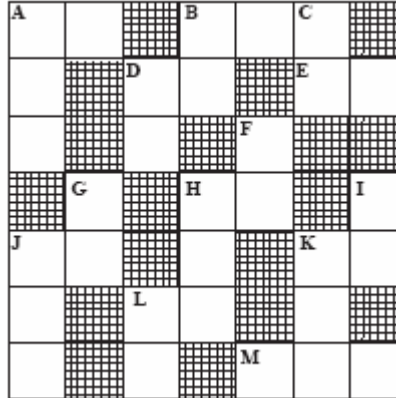
- Construct a regular icosahedron with edges of length 4 cm each.
- Using the given net, construct 20 triangular based pyramids.
- Paste the 20 constructed pyramids on the faces of the icosahedron.

Instrument - 02

- 1. Time of evaluation** : 1st term
- 2. The competency levels covered** : 14.1, 15.1, 6.1, 6.2
- 3. Relevant subject content** :
- Powers of a Product $(ab)^n \Leftrightarrow a^n b^n$ ($n \leq 3$)
 - Expansion
 - The Power of a Negative Integer (Index 1 – 4)
 - Algebraic Expressions
 - Construction and Simplification (Addition, Subtraction and with Brackets)
 - Substitution (Integers)
 - Factors of Algebraic Expressions with Three Terms
 - The Common Factor is a Whole Number
 - The Common Factor is a Term
- 4. Nature of the instrument** :
- Number Puzzles.
- 5. Aims of the instrument** :
- Solves number puzzles.
 - Constructs number puzzles based on algebraic expressions.
 - Displays the ability to work as a team.
 - Presents creatively completed work.
- 6. Instructions to implement the instrument:**
- For the teacher** :
- Inform the students about this instrument before the commencement of activity 14.1.
 - Instruct the students on how to prepare and complete the puzzle, emphasizing the fact that each square should be filled with exactly one digit.
 - Inform the students about the subject content and topics relevant to the puzzle.
 - Divide the class into four small groups.
 - Provide the groups with the puzzle in the Annex.
 - Inform the students of the date on which the completed puzzle and the prepared puzzle should be handed over.
 - Exchange the prepared puzzles and engage the students in completing the puzzles.
 - Evaluate the students based on the given criteria.

For the students

- Copy the given puzzle.



- Complete the puzzle using the given clues. (Each square should consist of only one digit)

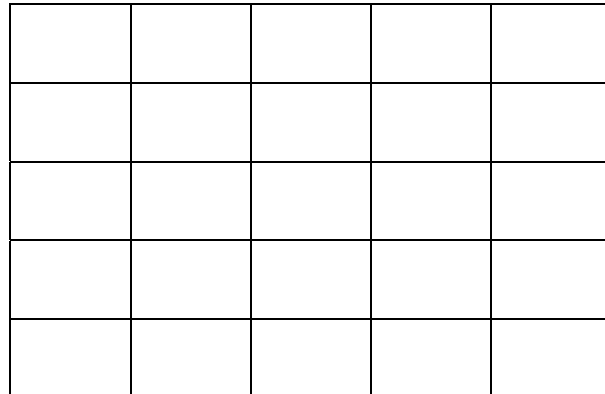
Clues

Down

- A** The value of 11×10^1
- C** A multiple of 7 which is the closest odd number to 50 less than 50
- D** The value of $(m + m^2 + m^3)$ when $m = 2$
- F** The coefficient of x when the brackets in the expression $3(5x - 2y)$ are removed
- G** The value of $(-3)^2 + (4)^2 + (5)^2$
- H** The value of $(ab)^n$ when $a = 5, b = 3, n = 2$
- I** The number which is 1 less than a half of 50
- J** The value of $(10^2 \times 3) + 4^2$
- K** The values appropriate for the empty squares in $4884 \div \square\square\square = 22$
- L** The value of $2^3 \times (-3)^2$

Across

- A** The value of 10 to the power 1
- B** When $8\square\square$ is divided by the first prime number, the value obtained is 422. The digits appropriate for the empty squares
- D** The value of $(p \times p)^p$ when $p = 2$
- E** The value obtained when 1 is subtracted from the common factor of $(100x + 200y)$
- H** The fifth square number
- J** The number obtained when the index of the expression obtained when (a^3b^3) is written as a power of a product, is multiplied by 10
- K** The value of $(x + y + z)$ when $x = 4, 2x = y$ and $3x = z$
- L** The value of $(-3)^4 + (-2)^3 + 2$
- M** The third power of the third prime number



- Copy the above grid.
- Shade some of the squares in a suitable manner.
- Write capital letters in a suitable manner.
- Create the necessary clues for the puzzle based on the subject content provided by the teacher (there should be at least 20 clues).
- Solve the puzzle using the clues.
- Handover the completed puzzle to the teacher on the assigned date.
- Complete the puzzles prepared by the other groups.

Criteria of allocating marks:

- Completes the puzzle accurately.
- Creates a puzzle in accordance with the given instructions.
- All members of the group aid in the process with enthusiasm.
- Makes certain to present a creative puzzle with clues that are clear and accurate.
- Hands over the completed task on the assigned day.

| | | |
|--------------------|----------------|----|
| Marks range | : Very Good | 04 |
| | Good | 03 |
| | Average | 02 |
| | Should Improve | 01 |

Instrument - 03

- 1. Time of evaluation** : 1st term
- 2. The competency levels covered** : 7.1, 1.1
- 3. Relevant subject content** : • Perimeter
 • Compound Plane Figures
 (Consisting of two of the figures
 Equilateral/Isosceles Triangles, Squares,
 Rectangles)
 • Square of a Number (1 – 20)
 • Square root of a Number (1 – 1000)
 • By Observation
 • Using Prime Factors
- 4. Nature of the instrument** : A creative activity
- 5. Aims of the instrument** : • Constructs compound plane figures and square shapes using various plane figures.
 • Determines the perimeter and area of various plane figures and inquires into the relationships between them.
 • Determines the square of a whole number.
 • Inquires into the methods of identifying a number which is a perfect square.
 • Selects numbers which are not perfect squares by observation.
 • Determines the square root of numbers that are perfect squares by considering their prime factors.
 • Prepares a report of facts on the square of a whole number and the square root of a number which is a perfect square.
- 06. Instructions to implement the instrument:**
- For the teacher** : • Introduce this instrument to the students before the commencement of activity 7.1.
 • Inform the students that this is a group activity which concludes with the creative preparation of a report based on the information that is collected.
 • Divide the class into four small groups.
 • Provide the groups with the required measurements and material to cut out rectangles from Bristol boards of the given colours, with dimensions the measurements given in the table below.

- Provide instructions to number the cut out shapes in order.
- Inform the students that the completed work should be handed over a week after activity 1.1 is completed.

| Colour Set | Pink | Blue | White |
|------------------|--|--|---|
| Group I Set A | 6 cm × 3 cm 6 cm × 5 cm 8 cm × 2 cm | 8 cm × 7 cm 7 cm × 4 cm 5 cm × 3 cm 9 cm × 5 cm | 25 cm × 8 cm 22 cm × 7 cm 20 cm × 10 cm 24 cm × 12 cm 14 cm × 13 cm |
| Group 2 Set B | 7 cm × 6 cm 7 cm × 3 cm 9 cm × 2 cm | 9 cm × 8 cm 8 cm × 6 cm 10 cm × 7 cm 7 cm × 5 cm | 25 cm × 13 cm 24 cm × 10 cm 20 cm × 11 cm 22 cm × 15 cm 11 cm × 10 cm |
| Group 3 Set C | 8 cm × 7 cm 8 cm × 3 cm 16 cm × 2 cm | 15 cm × 14 cm 15 cm × 11 cm 13 cm × 10 cm 12 cm × 10 cm | 26 cm × 9 cm 24 cm × 11 cm 22 cm × 13 cm 28 cm × 15 cm 15 cm × 11 cm |
| Group 4 Set D | 9 cm × 7 cm 9 cm × 4 cm 11 cm × 2 cm | 15 cm × 12 cm 13 cm × 12 cm 16 cm × 10 cm 18 cm × 16 cm | 25 cm × 11 cm 22 cm × 16 cm 28 cm × 19 cm 30 cm × 13 cm 12 cm × 11 cm |

For the students

- Based on the measurements and instructions given by the teacher, cut out and number the rectangles.
- Write the length and breadth of each shape on the shape itself.
- Using this information complete the following table

| Shape Number | Length | Breadth | Perimeter | Area |
|--------------|--------|---------|-----------|------|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

- Prepare 5 compound figures you like using two shapes each.
- Check whether the perimeter of the compound figure is equal to the sum of the perimeters of the figures used to form it.
- Study how the perimeter and the area of a rectangle changes when the length or the breadth is doubled, tripled, ... etc., and prepare a short report which includes all this information.
- Using the above rectangles, construct as many single coloured squares as you can.
- Complete the following table by finding the length of the sides of the squares and the area, using the measurements noted down on the shapes.

| Shapes that were used to construct the square (No.) | Area of each shape used cm^2 | Area cm^2 | Length of a side cm |
|---|--------------------------------|---------------------------|-----------------------|
| | | of the constructed square | |
| | ..., ..., ..., ... | | |
| | | | |
| | | | |

- Determine the square root of the value you obtained for the area of each of the squares you constructed and hence obtain the length of a side of the square.
- Compare the length of a side of a square obtained from the table, with the square root value obtained above
- Select two perfect square numbers between 500 and 1000 and find their square root by paying attention to the digit in the units place.
- Determine the square root of the numbers by using prime factors, and compare the two solutions.
- Prepare a report on the methods that can be used to determine the square root of a number which is a perfect square, as well as the instances when square roots are used.
- Creatively prepare a group product containing all the reports prepared from the commencement of this learning –teaching-assessment instrument.
- Hand over the completed work on the date assigned by the teacher.

Criteria of allocating marks:

- Accurately obtains the measurements related to the shapes.
- Uses various methods to find the square root of a number.
- Provides instances in which the square root is used.
- Individually provides maximum support towards a successful group effort.
- Prepares reports by including ideas and information logically and by organizing the facts.

| | | |
|--------------------|----------------|----|
| Marks Range | : Very Good | 04 |
| | Good | 03 |
| | Average | 02 |
| | Should Improve | 01 |

Instrument - 04

- 1. Time of evaluation** : 2nd term
- 2. The competency levels covered** : 23.1, 25.1
- 3. Relevant subject content** :
- Drawing and measuring the interior and exterior angles of plane figures
 - Triangle
 - Quadrilateral
 - Calculating the exterior angles based on the interior angles
 - Triangle
 - Quadrilateral
 - Rotational Symmetry
 - Concept
 - Centre of Symmetry
 - Order of Symmetry (Symmetrical Figures Only)
- 4. Nature of the instrument** :
- Creative Activity
- 5. Aims of the instrument** :
- Creates plane figures by being conscious of the order of symmetry.
 - Describes the conditions that need to be satisfied for a polygon with sides produced to have an order of symmetry which is greater than 1.
 - Displays the use of appropriate methods to determine the order of symmetry of a plane figure.
 - Prepares a display board on the rotational symmetry of plane figures.
- 6. Instructions to implement the instrument:**
- For the teacher** :
- Introduce this instrument to the class before the commencement of activity 23.1.
 - Divide the class into groups such that the maximum number in a group is 5.
 - Inform the students that they are required to construct plane figures with order of symmetry equal to 1, 2, 3, 4 and more than 4.
 - Inform them that their creations should be such that the order of symmetry can be examined.
 - Provide the groups with rigi-foam, tissue paper and pins.
 - Inform the students that the items they prepare should be suitable for display in the Mathematics Laboratory and that the completed work should be displayed in the Laboratory a week after the completion of activity 25.1

For the students

- Construct plane figures and polygons according to the table below (the order of symmetry of each shape should be according to the table).

| Order of Symmetry | Number of plane figures | Number of polygons with sides produced |
|-------------------|-------------------------|--|
| 1 | 3 | 1 |
| 2 | 3 | 1 |
| 3 | 3 | 1 |
| 4 | 3 | 1 |
| More than 4 | 3 | 1 |

- Using the rigi-foam, tissue paper and pins, prepare a display board so that the accuracy of the order of symmetry of the shapes you created can be confirmed.
- Prepare a short report on the special geometric features that polygons with sides produced and with the given order of symmetry should have, for you to be able to construct them.
- Place the prepared display board and report in the Mathematics Laboratory on the day assigned by the teacher.
- Gain experience by examining the accuracy of the creations of the other groups, which have been displayed in the Mathematics Laboratory.

Criteria of allocating marks:

- Creates plane figures with the given order of symmetry.
- Prepares a short report on the geometric features that a polygon with sides produced should have for it to be of order of symmetry greater than 1.
- Includes sufficient informative facts in the report.
- Presents a creative work.
- The group works with enthusiasm and dedication towards a successful production.

Marks range

| | |
|----------------|----|
| : Very Good | 04 |
| Good | 03 |
| Average | 02 |
| Should Improve | 01 |

Instrument - 05

- 1. Time of evaluation** : 2nd term
- 2. The competency levels covered** : 4.1, 4.2, 5.1, 5.2
- 3. Relevant subject content** :
- Dividing into a Ratio
 - Based on Amount and Time
 - The Total Amount when the Ratio is given
 - Compound Ratios from Equivalent Ratios
 - Fractions \Leftrightarrow Percentages
 - Solving Problems related to Ratios \Leftrightarrow Percentages
 - Percentage of a Quantity
 - Quantity when the Percentage is given
- 4. Nature of the instrument** :
- Wall Newspaper
- 5. Aims of the instrument** :
- Has an awareness of the methods of obtaining information.
 - Communicates information that is collected.
 - Relates a piece of information to various subject areas and describes it.
 - Prepares the final report by organizing the information that is collected.
- 6. Instructions to implement the instrument:**
- For the teacher** :
- Introduce this instrument to the class at the commencement of activity 4.1.
 - Inform the students that this instrument should be completed a week after the completion of activity 5.2.
 - Instruct the students to gather information on fractions, ratios and percentages, related to the various situations mentioned in the instructions to students.
 - Instruct the students to prepare a report suitable for a wall newspaper, which includes connections between the subject areas: the relationships between fractions, ratios and percentages, the total quantity when a percentage is given, compound ratios, and finding a percentage of a quantity.
 - Divide the class appropriately into groups.
 - Allocate marks based on the given criteria.

For the students

- Let each person in the group provide at least one newspaper per week. From the newspapers, gather information on fractions, ratios and percentages.
- Convert the information gathered in one of the forms fractions, ratios, percentages, into the other two forms and present it in tabular form.
- Prepare a report by requesting information from your teacher and other grownups on the ratios and percentages used in the following situations.
 - The ratio of cement, sand, stone and limestone in concrete/floor cement/plastering.
 - The ratio of sugar, flour, butter in sweetmeats/cakes.
 - The ratio of fruits, water, sugar in fruit drinks.
 - The ratio and percentage of different vitamins in multi-vitamin tablets and tonics.
 - The ratio of chemicals in fertilizers.
 - The ratio of the items in the mixture used when spraying insecticides and pesticides.
 - The ratio of the gases in the atmosphere.
 - The ratio of the different races in Sri Lanka.
- Tabulate as ratios, fractions and percentages, the information collected by all the members of the group.
- For each situation, propose an amount for one quantity of the ratio, and based on it find the amounts of the other quantities and the total amount and prepare another table with this information.
- Prepare a report suitable for a wall newspaper.
- Engage in a review regarding the experience you gained in gathering the information and also the problems you faced.

Criteria of allocating marks:

- Gathers information on percentages/fractions/ratios.
- Summarizes the information appropriately.
- Relating the gathered information to the relevant subject areas and prepares the report.
- Presents a creative finished product.
- Hands over the report on time.

Marks range

| | |
|----------------|----|
| : Very Good | 04 |
| Good | 03 |
| Average | 02 |
| Should Improve | 01 |

Instrument - 06

- 1. Time of evaluation** : 2nd term
- 2. The competency levels covered** : 17.1, 8.1, 8.2
- 3. Relevant subject content** :
- Constructing Linear Equations
 - Related to Real Situations involving Area, Sets and Time
 - Solving Linear Equations
 - Including Fractional Coefficients and with one Bracket
 - Area
 - Right-angled Triangles
 - Triangles
 - Compound Plane Figures
 - Surface Area of Solids
 - Cube
 - Cuboid
- 4. Nature of the instrument** :
- Puzzle
- 5. Aims of the instrument** :
- Constructs equations for real situations.
 - Solves the constructed equations.
 - Completes the puzzle using the solutions.
 - Creates puzzles related to equations.
- 6. Instructions to implement the instrument:**
- For the teacher** :
- Introduce this instrument to the class before the commencement of activity 17.1.
 - Inform the students that they need to construct equations and solve them .
 - Inform them that they need to construct equations with unknowns based on the clues, and solve them.
 - Explain that they need to complete the puzzle using the solutions to the equations, filling each square with a single digit. Inform them that the numerical values should be used without the units.
 - Inform them that they also need to construct equations relevant to real situations, solve them, and use the solutions to create a 5×5 grid puzzle.
 - Divide the class appropriately into groups and engage them in the task.

For the students

- : • As instructed by the teacher, construct equations relevant to the clues of the puzzle, by using appropriate unknown terms.
- Solve the equations.
- Complete the puzzle by entering the solutions.
- Create a puzzle of size 5×5 based on the subject areas given by the teacher.
- Present the puzzle creatively.
- Solve the puzzles created by the other groups.

Criteria of allocating marks:

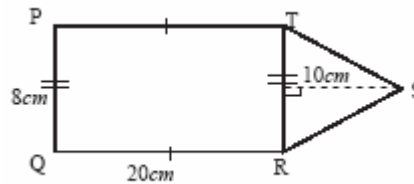
- Collects information on events by being sensitive to the environment.
- Constructs equations based on the information that is collected.
- Solves the constructed equations.
- Creates a puzzle and includes the solutions in it.
- Produces high quality work.

Marks range

| | |
|----------------|----|
| : Very Good | 04 |
| Good | 03 |
| Average | 02 |
| Should Improve | 01 |

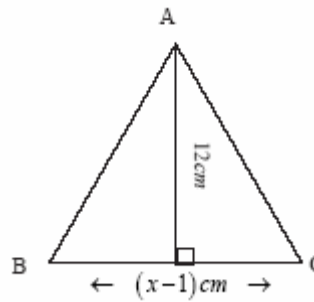
Across

- A The area of a rectangle with length twice its breadth and perimeter 60 cm
- B The number which when 5 is added to it and the sum is multiplied by 2 gives 30
- C When 9 km is added to half the distance between two towns, the value is 50 km. The distance between the two towns
- D The value obtained when 2 cm^2 is added to the area of the compound figure PQRST

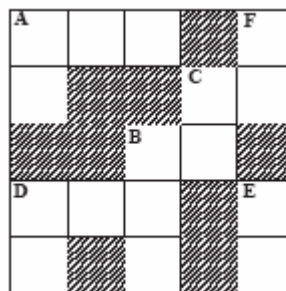


Down

- A The value represented by x when the area of the triangle ABC is 120 cm^2



- B My brother has twice the amount of cash that I have, and the sum of the amounts we both have equals Rs. 180. The amount of cash my brother has
- C Vinitha has twice the amount of cash that Neeta has. When Vinitha gives Neeta Rs. 40, they both have an equal amount of cash. The amount of cash that Neeta initially had
- D The length of a side of a cube with surface area 2400 cm^2
- E The length of a paddy field of breadth 50 m and area 3100 m^2
- F The sum of twice the number of elements in the set P and the number of elements in the set of days in a week is 31. The number of elements in the set P



Instrument - 07

- 1. Time of evaluation** : 3rd term
- 2. The competency levels covered** : 13.1, 13.2
- 3. Relevant subject content** : • Location
 • In terms of a Main Direction
 • In terms of Bearings
 • Explaining Scale Drawings
 • The Scale as a Ratio
 • Makes Scale Drawings
- 4. Nature of the instrument** : • Group Activity
- 5. Aims of the instrument** : • Applies the knowledge on bearings to determine the distance from a certain location to a place that cannot be approached.
 • Proposes suitable scales for scale drawings.
 • Makes scale drawings using suitable scales.
- 6. Instructions to implement the instrument:**
- For the teacher** : • Introduce this instrument to the class at the commencement of activity 13.1.
 • Divide the class into groups.
 • Provide the groups with suitable locations in the school grounds from which point they should find the distance to a location which cannot be approached. (It is even suitable to have the location that cannot be approached outside the school grounds)
 • Engage the students in the relevant task.
 • Inform the students of the date to handover the completed work.
 • Evaluate the work based on the given criteria.
- For the students** : • Mark a place in the North/South direction, a fixed distance (such as 2m/4m/5m/10m/....) from the location provided to your group by the teacher.
 • Determine the bearings from both places to the location that cannot be approached.
 • Mark the measurement you obtain on a rough sketch.
 • Based on the rough sketch, make a scale drawing using a suitable scale.

- Using the scale drawing, calculate the actual distance to the location that cannot be approached from the location assigned to you.
- Mention several day to day situations where scale drawings are used.
- Using a suitable scale, make a scale drawing of the floor plan of your house.
- Hand over the completed work to the teacher during the allocated time period.

Criteria of allocating marks:

- Uses bearings to find the distance to a place that cannot be approached such as a marshy land or a reservoir.
- Selects suitable scales and makes scale drawings.
- Has an awareness of the necessity of scale drawings in daily tasks.
- Measures accurately in daily tasks.
- Presents the completed work on the assigned date.

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| Marks range | : Very Good | 04 |
| | Good | 03 |
| | Average | 02 |
| | Should Improve | 01 |

Instrument - 08

- 1. Time of evaluation** : 3rd term
- 2. The competency levels covered** : 27.1, 27.2, 26.1
- 3. Relevant subject content** : • Introducing the Basic Loci
• Construction of Triangles (when the lengths of the sides are given)
• Semi-pure Tessellation (triangles and quadrilaterals)
- 4. Nature of the instrument** : • Students' Creations
- 5. Aims of the instrument** : • Constructs the necessary shapes using the knowledge on loci.
• Creates semi-pure tessellations using various shapes.
• Produces a high quality creation suitable for display.
- 6. Instructions to implement the instrument:**
- For the teacher** : • Introduce this instrument to the class at the commencement of activity 27.1 and inform the students about the criteria for the allocation of marks.
• Divide the class into groups.
• Direct the groups towards creating a semi-pure tessellation using equilateral triangles and squares.
• Instruct the students to use material such as wrapping papers from the environment for the tessellation.
• When required, advice the students to prepare nets when cutting out shapes and also to pay attention to the length of the sides.
• Inform the students to hand over the completed work within a week after the completion of activity 26.1.
• Obtain the required material such as paint as quality inputs to do the tessellation on a school wall or a classroom wall.
• Allocate marks based on the given criteria.

For the students

- : • All the members of the group collect suitable paper from the environment for the tessellation.
- Prepare appropriate nets to cut out the regular shapes named by the teacher.
- Using the nets, cut out the shapes using the colourful paper that was collected.
- Using the cut out shapes, prepare a semi-pure tessellation design suitable for a wall.
- On the assigned date, display the completed group work in the classroom.
- Using paint, decorate a school wall or classroom wall with a semi-pure tessellation similar in design to the completed work, but in a larger size.

Criteria of allocating marks:

- Prepares the nets and required shapes in a suitable manner.
- All members of the group aid actively in the task.
- Does the creation at a low cost with used material from the environment.
- Creates a semi-pure tessellation design using right colour combinations and considering other facts that contribute towards making the design attractive.
- Makes certain that the task is completed by the assigned date.

Marks range

| | |
|----------------|----|
| : Very Good | 04 |
| Good | 03 |
| Average | 02 |
| Should Improve | 01 |

Instrument - 09

- 1. Time of evaluation** : 3rd term
- 2. The competency levels covered** : 28.1, 29.1, 31.1
- 3. Relevant subject content** :
- Representation of Data
 - Tabulating Data
 - Central Tendency Measurements
 - Mode
 - Median
 - Mean
 - Measures of Dispersion
 - Range
 - Suitable Values of the Likelihood of an Event
 - Fraction of Success
 - Experimental Probability
 - Theoretical Probability
- 4. Nature of the instrument** : • A booklet
- 5. Aims of the instrument** :
- Tabulates numerical information.
 - Determines suitable representative values.
 - Indicates the relevant range.
 - Determines the experimental probability.
 - Expresses ideas about the theoretical probability.
- 6. Instructions to implement the instrument:**
- For the teacher** :
- Introduce this instrument to the class at the commencement of activity 28.1.
 - Divide the class into groups in a suitable manner.
 - Provide each group with an area of information such as
 - *The weight of the students in a class (to the nearest *kg*)
 - *The height of the students in a class (to the nearest *cm*)
 - * The time taken for students to arrive in school (to the nearest minute)
 - * Marks obtained for Mathematics at the term test. (If the number of students is insufficient, direct the students to obtain information regarding another area)
 - Ask the students to tabulate the gathered information.

- Instruct the students to determine appropriate representative values and the range. (Inform them that they are required to provide reasons for whether representative values can/cannot be found, after studying the information).
- Engage the students in an analysis of information based on the experimental probability and the theoretical probability.
- Inform the students of the date of submission of the work.

For the students

- : • Gather information on the area assigned to you.
- Represent the information in a suitable table.
- Determine representative values such as the mode, median, mean and the maximum value, minimum value and note down the information. Analyze the information.
- Indicate the range.
- Determine experimental probabilities for the events obtained as information.
- Verify with reasons whether the theoretical probability can/cannot be determined.
- Based on the analysis of the gathered information, prepare a booklet on the mode, median, mean, maximum value, minimum value, range and probability, as well as the problems encountered in carrying out this work

Criteria of allocating marks:

- Gathers information on the assigned area.
- Represents the gathered information in a suitable table.
- With reasons, provides suitable representative values.
- Presents conclusions and ideas that are based on the information.
- Presents the completed work on the assigned date by working with enthusiasm within the group.

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|--------------------|----------------|----|
| Marks range | : Very Good | 04 |
| | Good | 03 |
| | Average | 02 |
| | Should Improve | 01 |